

5-2015

# EngageMe: The Design and Implementation of a Reflective Tool for Evaluating Student Engagement

Shelby Solomon Darnell  
*Clemson University*

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# ENGAGEME: THE DESIGN AND IMPLEMENTATION OF A REFLECTIVE TOOL FOR EVALUATING STUDENT ENGAGEMENT

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A Dissertation  
Presented to  
the Graduate School of  
Clemson University

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In Partial Fulfillment  
of the Requirements for the Degree  
Doctor of Philosophy  
Computer Science

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by  
Shelby Solomon Darnell  
May 2015

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Accepted by:  
Shaundra Bryant Daily, Committee Chair  
Kelly Caine  
Sekou Remy  
Larry F. Hodges

# Abstract

Recently, there has been a growing push to explore the potential of non-cognitive factors in helping students reach their fullest potential. Engagement, one predictor of student achievement, is such a factor. Because the conditions under which engagement is elicited may vary, EngageMe, a visualization tool, has been developed to assist instructors' efforts to understand student engagement in the learning process. The application attempts to enhance traditional observation methods by utilizing electrodermal activity, a measure of physiological arousal, as a proximal indicator of engagement. An iterative, participatory design process was used to create prototypes of the EngageMe interface. The results of this design process, a study focused on the barriers to adoption of this kind of technology, as well as an exploratory case study are discussed. Finally, implications for future development are presented.

# Acknowledgments

The authors would like to thank the Bill and Melinda Gates Foundation which supplied the grant that first supported this research. The authors would like to thank the teachers that were so extremely instrumental in finishing this research, and the other graduate students from the MORPH lab who helped at various junctures.

Shelby Solomon Darnell would like to acknowledge my family (them jokas) who helped me through the entire process. Them jokas are:

- Deddy - Alfonza Darnell
- Mama - Carlen Darnell
- Natalie Nicole Darnell (coco)
- Narissa Ann Darnell (rissa)
- Alfonza Darnell Jr. (BiG Owl)
- Carl nmnn Darnell (Caaaa)
- Matthew “Wildcat” Darnell

Special shout out to Ghema Darnell, my Big Mama who passed in 2012.

Clemson University BGSA 2014-2015 been holding me down extra strong.

Dr. Frankie Felder, you are the best!



To my advisor, Shaundra Bryant Daily, you've been more than I could have asked for in an Advisor, for this you will forever be a recipient of my gratitude.

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# Chapter 1

## Introduction

The roles that data can play in instructional processes are varied, including assessing subject matter comprehension [27], making predictive models [8, 50], discovering trends and biases [37, 68], and supporting decision-making [71]. The data and tools instructors use to support decision-making, in particular, are very complex. In a classroom environment, an instructor, at any given instance, must process and take action based on information gleaned not only from professional training, but also from a myriad of data generated in real-time [14, 28]. Some of these data, such as the number of students in the classroom, whether or not a particular student is standing or sitting, whether or not a student is asleep, drowsy, alert, or whether or not students are conversing with one another are easily detected and monitored. Others, such as mood or learning challenges, are individual and context-dependent variables that may be difficult to objectively and accurately assess. Student engagement, which correlates directly to student performance falls into the latter category [3, 26, 31, 32, 35, 40, 69, 38].

The conceptualization and design of a tool that utilizes data for instructional processes is the primary topic of this paper. A key issue related to instructor as-

assessment of engagement in the classroom setting is the lack of a robust, objective measure for the phenomenon. Engagement, it turns out, is one of the dimensions of the student classroom experience that is of most interest to instructors [3], but it is also one of the hardest dimensions to reliably define and quantify. This means that, regardless of the instructor’s experience level, the detection and reporting of student engagement is entirely subjective. In stark contrast, many instructors could benefit from data-driven methods that support their efforts by providing them quantitative information on students’ attentional responses to their pedagogical methods.

## 1.1 Research Approach

The overall goal of this dissertation is to investigate electrodermal activity (EDA) as a basis for supporting teachers’ reflective practice. In order to work toward this goal, I ask three questions, including: 1) What kind of tool can support teacher reflective practice in the classroom? 2) What are the barriers for adopting physiology-based technologies in the classroom? and 3) Do teachers find the system useful and usable?

**Question 1: What kind of tool can support teacher reflective practice in the classroom?** **Approach:** Co-developing a software-based analysis tool that enables reflective practice. This portion of the research has been a partnership with teachers and administrators in a North Carolina school district. Several focus groups were conducted resulting in both paper and digital prototypes, which led to a web based software solution called EngageMe that syncs video data with electrodermal activity, allows for note-taking at specific points in the event, and provides a visualization of high, medium, and low levels of arousal for both groups and individuals.

**Question 2: What are the barriers for adopting physiologically-based technologies in the classroom?** **Approach:** To understand the social, political and cultural barriers for adoption of these types of measures and this tool, a large-scale feasibility study was conducted to understand the challenges and opportunities related to the tool. From this research, I have public perception data from a real situation confirming that those interested in introducing pervasive technologies must fully describe a system’s goals and possible limitations, they must emphasize respectful (e.g., opt in) opportunities to use the technology, and they have to provide intended users with choices about how, when, and where their data can and cannot be utilized.

**Question 3: Do teachers find the system useful and usable?** **Approach:** We used a participatory design process with teachers leading to the creation of a tool that assists instructors in decision making by maximizing their access to student arousal data without demanding additional time-consuming training in order to interpret said data. Now that we’ve applied participatory design to our process and considered the barriers to entry for our technology specifically, we want to see how useful the tool is perceived as being. Along with perceived usefulness teachers provided feedback about student behaviors and usability of the system overall. The teachers who will be asked for feedback will have participated in the design process.

## **1.2 Dissertation Organization**

This dissertation begins with an exploration of the concept of engagement, explains the importance of teacher reflective practice and moves on to an overview of qualitative and quantitative approaches to student engagement assessment. Next, a case for the use of participatory design in the development of the proposed tool



is made. Subsequently, iterations of the participatory design process that led to the creation of the proposed application are described. The lessons learned from the design process and their implications for future work are shared. Following the exploration and discussion of the design process, application implementation details are described. Because the purpose of EngageMe is to better understand and improve student engagement, privacy and ethical concerns are reviewed and addressed. Finally EngageMe is used in an exploratory classroom study of student engagement.

# Chapter 2

## Background and Related Work

### 2.1 Electrodermal Activity (EDA)

The regulation of physiological states of arousal is supported by balanced activity within the sympathetic and parasympathetic divisions of the autonomic nervous system. The sympathetic nervous system (SNS) and parasympathetic nervous system (PNS) are often likened unto the gas and brakes of a car respectively; aiding “fight and flight” versus “rest and digest” activities. While the SNS prepares the body to act on changing environmental conditions by accelerating heart rate, constricting blood vessels, and raising blood pressure, the PNS dilates blood vessels leading to the digestive tract, stimulates salivary glands, and constricts the bronchioles of the lungs. As SNS activity increases, sympathetic fibers that surround eccrine sweat glands increase the production of sweat. The skin, in turn, momentarily becomes a better conductor of electricity (i.e., electrodermal activity) [60, 65]. EDA is at times referred to as galvanic skin response (GSR).

The Q sensor (figure 2.1) was chosen to collect skin conductance, temperature, and motion data since this sensor can be worn outside of a laboratory setting (i.e.,



Figure 2.1: Q Sensor

without being tethered to a computer) and since it is worn on the wrist like a watch, which might increase the possibility of it being unobtrusive to the student. This sensor provides information about a person's level of arousal provided that other triggers of increased perspiration have been held constant (e.g. temperature). It will not provide any information as to the specific emotion that is being elicited unless other conscious emotion variables are collected.

Further, numerous events such as pain, significant thoughts (not related to the current context), lying, exercise, individual changes in biochemistry, and motion artifacts can lead to changes in skin activity. Even with attribution and noise limitations, however, electrodermal activity is a useful measure that has been used in research focusing on stress and anxiety [29], lie detection [58], user interface evaluation, empathy [47, 46] and game assessment. The final two are most relevant to the system under development in the classroom setting. By measuring skin conductance simultaneously from patients and therapists during a one-on-one clinical session, Marci et.al. [46] found that increased therapist empathy as perceived by the patient correlated with high concordance of skin conductance between the patient and therapist. In other words, the more empathic the patient felt her therapist to be, the stronger (better correlated) the relationship between skin conductance measures.

Next, Mandryk et. al. [45] found that skin conductance was higher when playing a game against a friend rather than a computer and was correlated with subjective measures of “fun”. Further, in a separate study, Mandryk et. al. [44] found that a combination of physiological measures, which included skin conductance, were useful in evaluating the emotional response to entertainment technologies.

## 2.2 Defining Engagement

The phrase “engagement,” particularly in the context of education, is frequently used as if engagement is a well-defined, monolithic concept. This, of course, is not the case; it is multi-faceted [3, 35]. The beginnings of a more formal understanding of engagement can be found in a review of the topic written by Fredricks, Blumenfeld, and Paris [35]. Here, the authors assert, based on a survey of the literature, that engagement is a multidimensional meta-construct consisting of three components: behavioral, emotional, and cognitive engagement [35]. Cognitive engagement is related to investment in learning, goal-setting, and self-regulation; examples include problem-solving, seeking out challenges, and the development of expertise [3, 35, 53, 74]. Behavioral engagement is related to participation and involvement; the concept includes observable behaviors such as attendance, task completion, and voluntary, active classroom participation [35, 53, 74]. Emotional engagement is related to the affective experiences of students; it can be characterized by reactions such as interest, boredom, happiness, or anxiety and by feelings of belonging or connectedness in the learning setting [3, 40, 53, 74]. A rigorous discussion of engagement, thus, requires acceptance of the multifaceted nature of engagement, as well as an acknowledgment that what engagement “looks like” for any particular individual may change in response to a variety of internal or external factors.

## 2.3 Teacher Reflective Practice

Teacher reflective practice is considered a necessity for effective teaching, and is very well represented in the literature concerning effective teaching [43, 54, 63]. Reflective practice is the continual monitoring of teaching effectiveness and student learning outcomes before, during and after teaching which can be accomplished individually or in groups. Reflective practice often requires assessment tools, plans and goals. The National Board for Professional Teaching Standards (NBPTS) publishes the “Career and Technical Education Standards for teachers of students ages 11-18+” [54]. It contains an entire chapter on reflective practice, underscoring its importance to effective teaching practice. Two of the five core propositions from the National Board’s document *What Teachers Should Know and Be Able to Do* are: teachers think systematically about their practice and learn from experience and teachers are members of learning communities. These propositions correspond directly to two types of reflective practice: individual reflection and reflection with partners or groups [61]. The NBPTS further states “Accomplished teachers reflect analytically throughout the instructional process, using multifaceted feedback to increase the efficacy of their teaching, strengthen its impact on student development, and model the significance of lifelong learning” [54]. EngageMe is a tool that allows for either individual or group reflective practice by allowing teachers to review their interactions and teaching styles while being able to view student physiological response.

## 2.4 Student Engagement Assessment Methods

To date, much of the evaluation of the various dimensions of engagement has relied on the subjective and qualitative instruments of self-report and observation [35].

Observation, perhaps the oldest assessment method, is a process in which observers monitor facial expressions, behaviors, or other social cues. If the observers are also instructors, these observations must be noted while simultaneously managing other classroom duties. This method of evaluating engagement is based completely on human expertise and experience; thus, it may not be reliable or consistent, and, in practice, may be very difficult for pre-service teachers to execute.

Attempts have also been made to understand student engagement through the use of surveys or self-reports [4, 34, 40, 53, 57]. A study conducted by Blumenfeld and Meece (1988), for example, attempted to measure cognitive engagement and the distinctions between superficial and higher level strategies. Nearly two hundred fourth through sixth grade students were interviewed. The students were also asked to complete surveys, and they were observed in the classroom. The researchers found that student involvement did not differ significantly by difficulty of cognitive content, type of social organization, or procedural complexity of tasks [11]. A more recent study was conducted by Yazzie-Mintz and McCormick (2012). Here, the researchers analyzed the results of the High School Survey of Student Engagement (HSSSE), a survey instrument developed by scholars at Indiana University. The results of the 2009 HSSSE were generated from the directed and free-form responses of 42,754 students from 103 high schools across 27 different states [74]. The researchers found that 74% of respondents reported that teacher lectures either engaged them “a little” or “not at all” and that 83% of respondents reported uninteresting course materials as the origin of their boredom in class [74]. Both of these examples provide interesting ideas for consideration; they also, unfortunately, share the problem of self-report. In other words, there is no certainty that the participants survey and interview answers were representative of their actual mental states.

Observations, surveys, and self-reports have the potential to generate valu-

able data, the inherent limitations of these methods, however, have led researchers towards developing digital tools to assist instructors in the understanding of student engagement. One such attempt is the Subtle Stone [2]. The Subtle Stone is a wireless hand-held squeezable ball that allows students to communicate their affective and motivational experiences to their teachers in real time. The ball has seven different colors, and each student in the class can customize the “stone” to represent their own emotional language by associating specific colors with specific emotions they want to communicate. When in use, students squeeze the sensor to cycle through colors until they reach the emotion they wish to express in that moment. Thus, one drawback of this tool is that the feedback delivered to the teacher is heavily dependent on the student’s self-report. In addition, the cognitive load imposed on the instructor may be high depending on the number of students in the classroom and the level of variation between students emotional color schemes. Finally, the possible distraction of the students from the instruction as they attempt to express utilizing this tool, could be an issue.

Utilizing technology, but moving away from self report, Bidwell and Fuchs (2014) used video recording feeds to extract student gaze targets from the footage. In their methodology, experts first train a student engagement classifier using observation data collected during a recorded lesson [9]. This expert observation is then paired with sequences of student gaze, and a hidden Markov model-based student engagement classifier is built. Finally, researchers studying intelligent tutoring systems have identified learner engagement and affect by monitoring conversational cues, gross body language, and facial features with a variety of sensors [23, 73]. The work presented here differs from the intelligent tutoring system work in two key ways: 1) a single sensor measuring a physiological response is utilized, and 2) the physiological information is provided to a human teacher, rather than an intelligent system, who

can make judgments about how to move forward.

In the application, data collected from wrist-worn sensors [1] is transformed into information related to individual students levels of physiological arousal and reported to the instructor. Physiological arousal, the magnitude of which can be determined from the measurement of skin conductance, is one of the two major dimensions of an emotional response; valence, the positive or negative nature of the response, is the second determinant [48, 64]. Because it captures only half of the emotional “picture,” arousal, as measured by skin conductance, is neither equivalent to emotion nor engagement; hence, arousal data alone isnt enough to improve the instructional processes. Its close relationships to emotion, attention, and memory, however, make it a reasonable proxy for engagement in the proposed tool until a more comprehensive measure is established.



# Chapter 3

## Design and Implementation

Thus far, I have been working to address the first two research questions. Three rounds of participatory design iterations including meetings with stakeholders have been conducted. These iterations have included ongoing software design and development, described in 3.4. The research on barriers to adoption has focused on issues of privacy and trust, and is explored in detail in section 4.1.

### 3.1 Research Question 1

What kind of tool can support teacher reflective practice in the classroom?

### 3.2 Research Approach

Pioneered in Scandinavia, participatory, or cooperative, design is an “approach towards computer systems design in which people destined to use the system play a critical role in de-signing it” [16, 25, 67]. The approach advocates three major tenets: 1) the ultimate goal of the process should be demonstrated improvement of the quality

of users work lives; 2) the orientation of the work should be collaborative; and 3) the process should be iterative [10]. Participatory design attempts to democratize the design process by engaging users as fully empowered participants in the design process [25, 52]. In this model of system development, users are considered domain experts, and designers are considered consultants with the technical skills necessary to help users construct desired tools [20]. These ideas stand in direct contrast to older design strategies in which system experts design systems and users are expected to develop competency in system use either through practice or extensive training [72].

The motivations for the use of participatory design are not merely philosophical. Successful applications of participatory design result in systems that reflect the interests of the parties directly affected by the system and support users their innate strengths [25, 33]. In addition, collaboratively designed systems are both user-centered and activity-centered [39, 55]. As a consequence, they are much more likely to effect positive change by include features that improve both user productivity and user experience [7, 55]. Expert-designed systems, by contrast, rarely take into account users wants, needs, goals, motivations, or parallel work activities.

Developing an understanding of both users and their activities is critical not only for system design, but also system acceptance. When end users have an opportunity to engage in the process of technology design at its earliest stages, they also have the opportunity to develop ownership of technology, comfort with the technology, and expertise with the technology [18, 17, 49]. These connections with technology design are especially important when the user group is teachers. The rise of the use of learning analytics to provide “actionable intelligence” on students’ learning presents a major challenge to system designers to create both user interfaces and data visualizations, which are clear and useful to instructors [41]. Also, the wide range of information that is accumulated in the classroom needs to be processed such

that the instructors can easily use those data to refine their pedagogical strategies and increase student engagement. In short, the cognitive and temporal demands of instructors require that any technological intervention proposed for in-class use must be robust, easy to understand, and require little-to-no additional training to interpret the results. If these conditions are not met, there is an increased likelihood of technology adoption failure. For all of these reasons, a participatory design process has been chosen to guide the design of *EngageMe*, an application that is tailored to the needs of our user group, 6<sup>th</sup> – 8<sup>th</sup> grade teachers.

### 3.2.1 Participants

For our study, we established a partnership with a public school in the southeastern United States. Specific participants were recruited via their principal, and they had no prior knowledge of the details of the study. Over the course of a 17-month period, several 6<sup>th</sup> – 8<sup>th</sup> grade instructors, primary stakeholders, participated in three design-oriented focus groups. Eleven (11) teachers participated in the first focus group. 82% of initial participants took part in the second focus group, and 45% of initial participants took part in the third focus group. According to focus group members, personnel changes over the course of the study were the primary cause of attrition.

Following the initial focus group with instructors, a single focus group with school administrators, secondary stakeholders, from the same school district was held for the purpose of comparison. Seven (7) administrators, including two principals, a professional development specialist, a responsiveness to instruction specialist, a high school instructor, an education professor, and a project executive director, participated in the secondary stakeholder group session.

### 3.2.2 Instructor Focus Group 1 - Primary Stakeholders

During the first instructor focus group, participants were provided background information about the project. We next gave participants the opportunity to see and touch Affectiva Q sensors, non-invasive, wrist-worn devices used to sense and record EDA. Participants were subsequently asked a series of questions to learn about instructors' mental models of engagement. Such questions included: "How do you define engagement?," "How do you determine whether or not a student engaged in your classroom?," and "If you had an ideal tool to facilitate the assessment of engagement, what would it look like?". Instructors were then asked to contribute drawings of their design ideas for the hypothetical application (Figure 3.1). Participants were intentionally not shown any preliminary user interface images to reduce the likelihood of inadvertently introducing bias into the creative process.

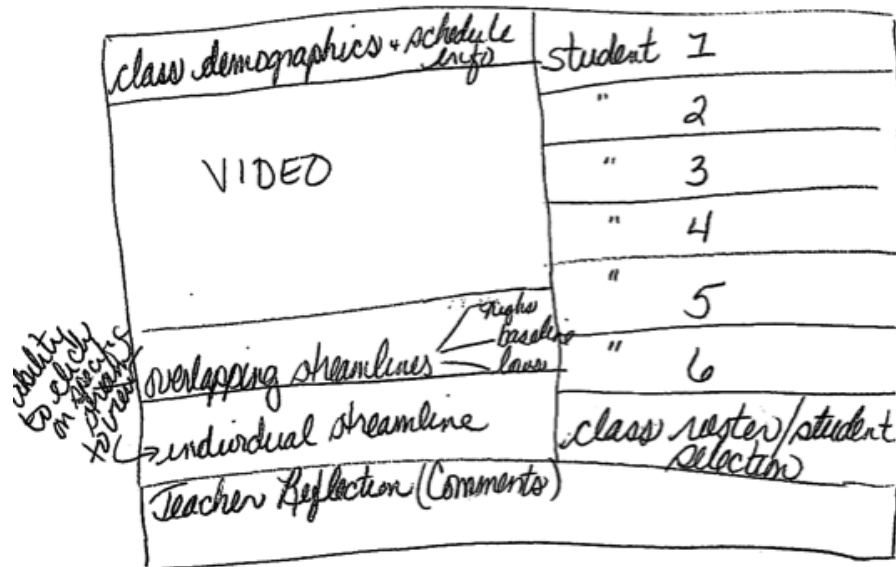


Figure 3.1: Example of participant-generated data collect during Instructor Focus Group 1

Table 3.1: Text Analysis - Instructor Focus Group 1

| Rank | Word        | Occurrences in notes | Frequency in notes | TOTAL words analyzed |
|------|-------------|----------------------|--------------------|----------------------|
| 1    | students(s) | 17                   | 5.6                | 302                  |
| 2    | data        | 10                   | 3.3                |                      |
| 3    | time        | 7                    | 2.3                |                      |
| 4    | teacher(s)  | 7                    | 2.3                |                      |
| 5    | use         | 6                    | 2.0                |                      |

### 3.2.2.1 Analysis of Instructor Focus Group 1 Data

Text mining, an exploratory, content-driven method of analyzing qualitative data [36], was used to quantitatively evaluate the sentiments of the focus group participants. Textalyser, an open-source, online text analysis tool ([www.textalyser.net](http://www.textalyser.net)), was used to perform this analysis. Word counts and word frequencies for Instructor Focus Group 1, as calculated by Textalyser, are shown in Table 3.1.

Text analysis though informative, cannot be used to derive an understanding of why the most frequently used words are priorities for the participants. Thematic analysis, a more qualitative analysis method, was used for this purpose. Upon examination of the field notes from the focus group, three (3) major themes: Informative Feedback, Support For Viewing Either Individual or Group Data, and Immediate Access To Data were identified. The details of how these themes were identified, including supporting data, are published elsewhere [21]. Teachers in general, however, wanted a real-time or reflective tool that could provide them with classroom- or individual-level information for adjusting classroom practices.

### 3.2.2.2 Design Iteration 1

The conversational notes, written suggestions, and drawings collected during Instructor Focus Group 1 were used to guide the first user interface design iteration. These data clearly demonstrate the importance of students to instructors both explic-

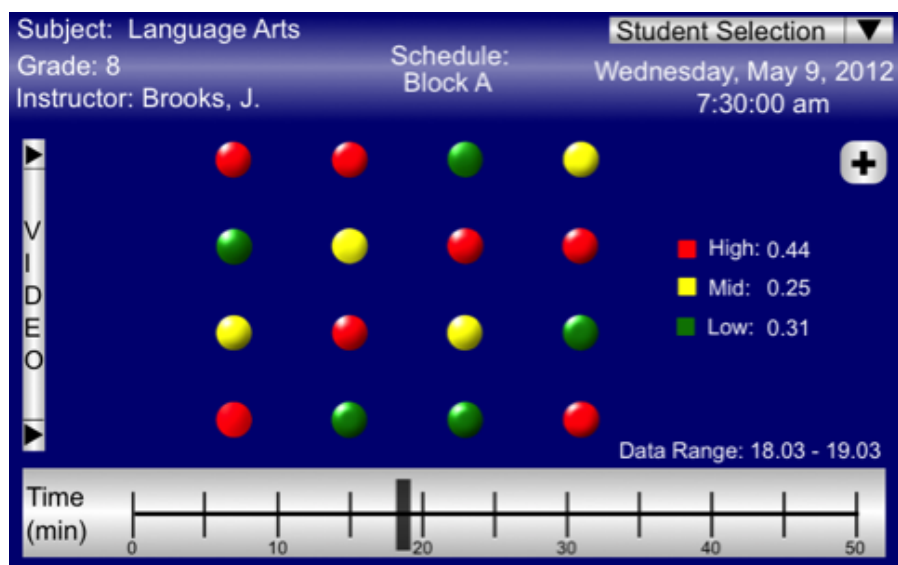


Figure 3.2: Design Iteration 1 - Interface Mock-up (Group View)

itly and implicitly (See section 3.2.2.1 Analysis of Instructor Focus Group 1 Data). The results from the thematic analysis were directly translated into design elements in the mock-up of the proposed application interface (Figures 3.2 and 3.3). First, support for viewing either individual or group data was provided by the creation of two separate, but related, viewing screens (Figures 3.2 and 3.3). Due to the static nature of the images, it should be noted that the Individual View (Figure 3.3) was designed to be accessed via the Group View (Figure 3.2) in the mock-up. Color-coded dots were next added to the design of the Group View to address instructors' common desire for informative feedback (Figure 3.2). In this view, each dot represents a student, and the color of the dot represents his or her corresponding mean arousal level, based on five minutes of skin response data. Note, a legend, which is displayed in the right-central section of both views, has been included to reduce the cognitive load associated with remembering the relationship between student engagement the displayed colors. Instructors' common desire for informative feedback was also accommodated by the addition of two related features to the Individual view: a

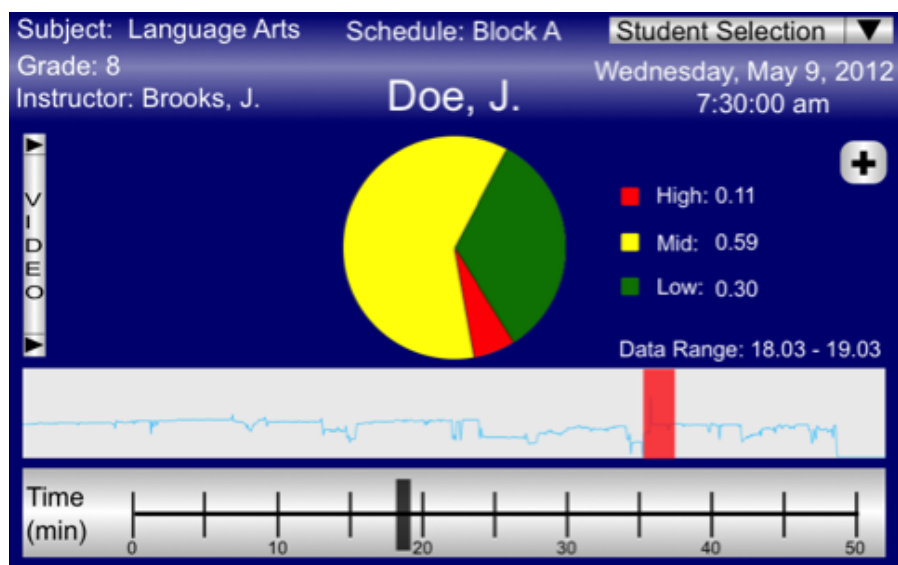


Figure 3.3: Design Iteration 1 - Interface Mock-up (Individual View)

pie-chart displaying the total percentage of time a particular student spent at either high, medium, or low levels of engagement and a line graph displaying the underlying EDA data used to calculate engagement for the corresponding student (Figure 3.3). The inclusion of the EDA line graph also fulfills, in part, instructors' common desire for Immediate Access to Data. Additional design features, made available across the proposed application, include the option to play associated video data (represented by the "VIDEO" bar displayed on the left edge of each view), the option to add notes (represented by the "+" button displayed in the upper right corner of each view), and the option to simultaneously scroll through all available data streams (represented by the "Time" bar displayed on the bottom edge of each view) (Figures 3.2 and 3.3).

### 3.2.3 Instructor Focus Group 2

The next primary stakeholder focus group was critical, rather than exploratory, in nature. In this session, instructors were presented with the interface mock-ups created during Design Iteration 1 (Figures 3.2 and 3.3). Two possible viewing screens

Table 3.2: Text Analysis - Instructor Focus Group 2

| Rank | Word        | Occurrences in notes | Frequency in notes | TOTAL words analyzed |
|------|-------------|----------------------|--------------------|----------------------|
| 1    | students(s) | 11                   | 4.5                | <b>243</b>           |
| 2    | data        | 8                    | 3.3                |                      |
| 3    | teacher     | 6                    | 2.5                |                      |
| 4    | seating     | 5                    | 2.1                |                      |
| 5    | work        | 5                    | 2.1                |                      |

for the proposed application were shown. The first screen represented a “birds eye” view of all students in the classroom, color-coded by engagement level (Figure 3.2). The second displayed graphical representations of both time-dependent EDA data and the relative amount of time that an individual student spent in high, low, or medium levels of engagement (Figure 3.3). After viewing the mock-ups, participants were asked to share their thoughts on how these designs might be modified to better fit their needs.

### 3.2.3.1 Analysis of Instructor Focus Group 2 data.

It was hypothesized that participant sentiment might shift toward a more data-oriented view before versus after the mock-up viewing. A text analysis of the Instructor Focus group field notes, also using Textalyser (See section 3.2.2.1 Analysis of Instructor Focus Group 1 Data), was performed to test this hypothesis. Results, shown in Table 3.2, reveal that none of the teachers continued to have a similar focus both before and after viewing the paper prototype.

Again, using thematic analysis, a list of key design criticisms was constructed based on instructor feedback. The primary themes, illustrated by direct quotations from participants, were as follows:

- Theme 1 – The color-coding scheme is not consistent with expected symbolic meanings (Example: “Could green be high and red mean not engaged?”).



- Theme 2 – The static arrangement of “students” in the Group View does not reflect the dynamic nature of the classroom (Example: “[I would like the] flexibility to program the seating arrangement on a daily basis during an average week I re-arrange my desks and students 3 to 4 times.”).

### **3.2.3.2 Design Iteration 2.**

Data collected in Instructor Focus Group 2 were used to facilitate implementation of the first functional prototype of the EngageMe interface (Figures 3.4, 3.5, and 3.6). This digital prototype, constructed in Adobe Flash Builder, features a classroom view (Figure 3A) and an individual student data view (Figure 3B). Key features of the digital prototype include: the ability to interface with an underlying database, the ability to load and view video data (Figures 3.4, 3.5, and 3.6), the ability to load and view time-dependent EDA data (Figure 3.5), the ability to take notes (Figure 3C), and the ability scan through all time-variant data simultaneously using a synchronized scrollbar (Figures 3.4, 3.5, and 3.6).

Instructors’ common desire for more intuitive color-coding was accommodated by changing the definitions of the colors within the software. Similar to the scheme of a U. S. traffic light, red, in the digital prototype indicates “low arousal/take action,” yellow indicates “moderate arousal/monitor,” and green indicates “high arousal/continue”. Transitioning to this more familiar color scheme eliminated the need for an explanatory legend. The ability to move dots in the Group View and create custom seating arrangements was not implemented in this design iteration; addition of these features, however, will be considered for future versions of the application.

EngageME

Subject : 8280 Theory of Programming Languages

Grade : 99

Instructor : Murali Sitaraman

March 15, 2014 10:15:37 PM EDT

Date

mcp 001

mcp 002

mcp 003

mcp 004

mcp 005

mcp 006

mcp 007

mcp 008

mcp 009

mcp 010

mcp 011

mcp 012

mcp 013

mcp 014

mcp 015

mcp 016

mcp 017

mcp 018

mcp 019

mcp 020

mcp 021

mcp 022

Time (s)

0:05/1:19:06

Figure 3.4: Design Iteration 2 – Screenshot of digital prototype (Group View)

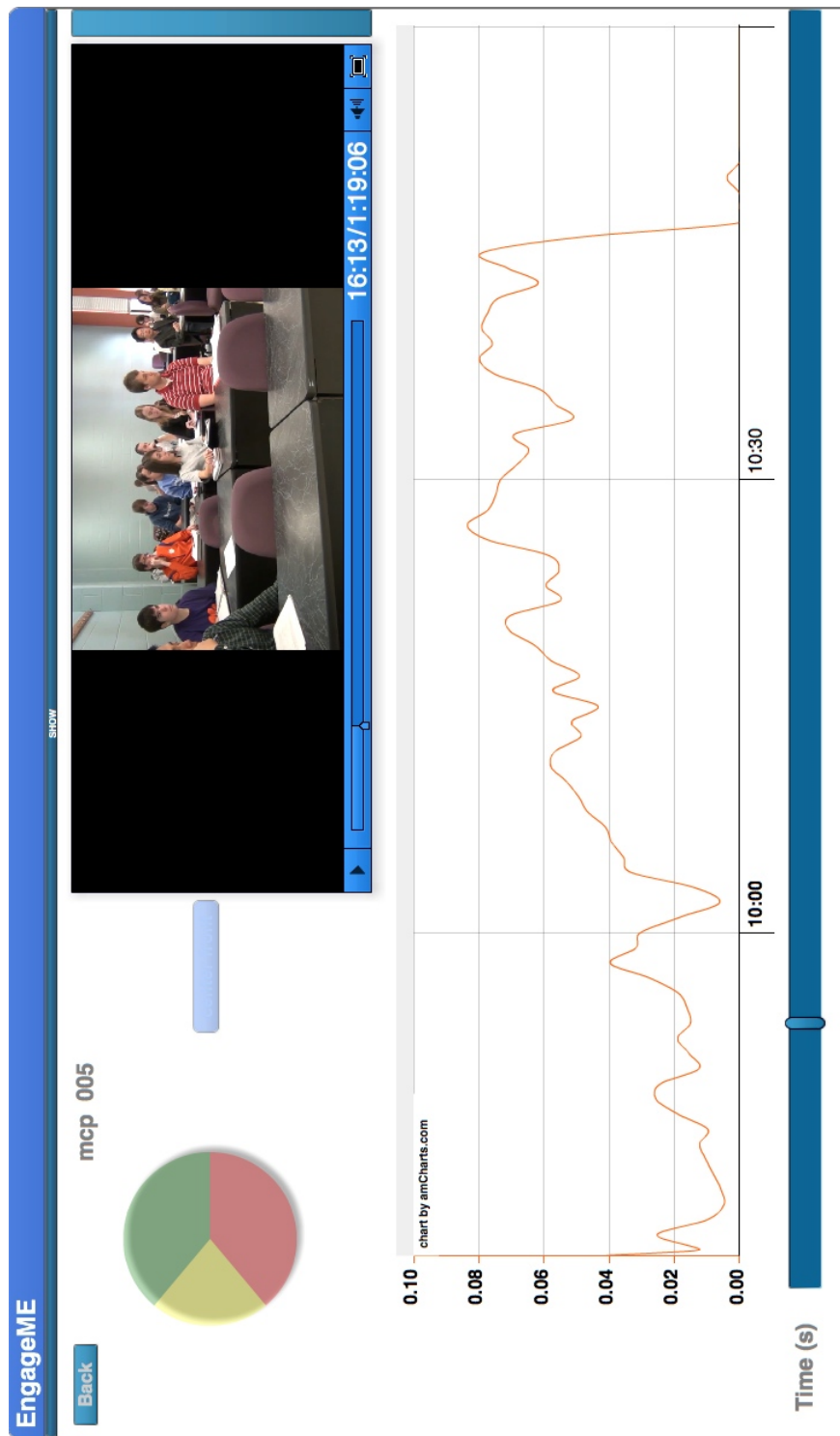


Figure 3.5: Design Iteration 2 – Screenshot of digital prototype (Individual View)

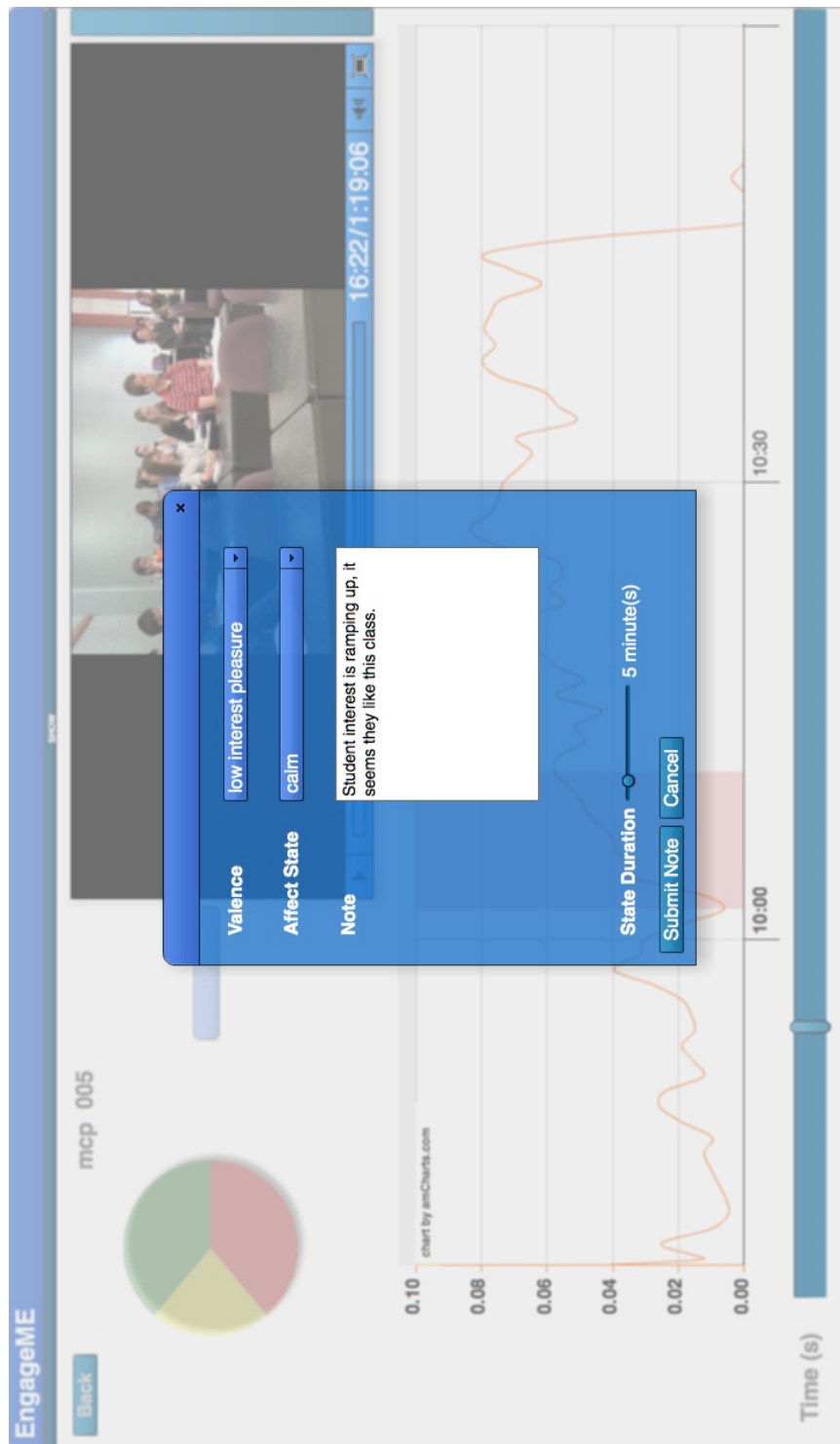


Figure 3.6: Design Iteration 2 – Screenshot of digital prototype (Note View)

### 3.2.4 Instructor Focus Group 3

The third focus group with instructors was arranged for the primary purpose of demonstrating the design and functionalities of the digital prototype. Critiques of the prototype’s design were solicited, but no major changes to the design were suggested. The changes that were suggested consisted of adding a graph visualization to the group view that plots each students engagement levels, one on top of the other, for easy comparison/contrast over an entire class period. Reactions to the digital prototype were overwhelmingly positive. Representative sentiments include “[The note taking feature is] cool!” and “I want to put [skin conductance sensors] on [generally excited student] right now!”. Aside from the positive reaction to the tool built from their prior input, the focus group had more suggestions on how to visualize the data. We’ve decided to implement some of those suggestions in a future revision.

## 3.3 Discussion

What kind of tool can support teacher reflective practice in the classroom? To answer this question, I have described a stepwise, collaborative process by which the first fully functional prototype of *EngageMe*, a software tool to facilitate sense-making around student engagement in the classroom context, has been designed. Introducing a new technology into an environment is always a challenge for both researchers and users. The development of familiarity with the new technology takes time, and the needs and attitudes of the user group must be studied and understood before it can be successfully launched. Care in understanding the users of education technologies is especially important because teachers, parents, students, and administrators are all stakeholders in the educational process. Each one of these stakeholder groups has an investment in understanding which pedagogical methods best meet the educational

needs of both individual students and specific student groups, and each has a unique set of priorities and concerns. Teachers, due to their central relationship to each of the other stakeholder groups, are ideal collaborators for the design and implementation of new educational technologies.

Prior to analysis, it was hypothesized that, after instructors had the opportunity to actively participate in the design process of the interface from the beginning (i.e., Focus Group 1) and to see how their ideas, values, and opinions directly influenced the proposed interface design (i.e., Design Iteration 1), their concerns would markedly shift regarding how data would be presented within the interface. The evidence, however, did not support this hypothesis. The text analyses of the notes from Instructor Focus Groups 1 and 2 reveal that the primary concern of instructor's was students (Tables 3.1 & 3.2). This observation was the same both before and after the introduction of the paper prototypes.

### **3.4 Technical Development**

The first digital implementation of EngageMe was created after the second focus group design session. The study software uses Oracle's MySQL database to store the data from the EDA sensors to allow individual and group analysis of information. Storing the recorded EDA signal in the database promotes ease of data transformation and multiple signal comparison. Adobe's flex SDK is used through the Adobe Flash Builder product. In order to display the gathered information in an understandable form, remote procedure calls (RPCs) are used to connect the Flex/Flash front end with the python back end. Python classes and scripts are employed for database communication and information processing. The python back end is responsible for data normalization, smoothing, filtering, synchronization, analysis, and transforma-

tion. Actionscript provides the interface between the RPCs to python and the display of information.

Adobe Flash Builder is a proprietary product by the Adobe company. The Adobe Flash Builder framework uses its own set of languages, server technology and add-ons. Adobe has its own proprietary ecosystem for developing web technologies. Transformative open source web technologies like CSS3 and HTML5, along with numerous javascript libraries, are an amazing alternative to Adobe's proprietary tools. Finding suitable libraries for developing EngageMe using the Adobe ecosystem was time consuming and disappointing because, funds are limited and the best libraries cost money to utilize. After struggling to find suitable libraries and implementing a full version of EngageMe we showed teachers who would possibly use the system. The teachers gave suggestions for improvement, and we decided our purposes would be better served by re-implementing EngageMe using a different web framework. The web framework, to which we switched, is called Web2Py, that allows python script to be written within HTML code. Using the Adobe framework we had to use an intermediate server technology in conjunction with remote procedure class (RPCs). This process slows down the transmission and display of system data. It also makes setting up a centralized server for hosting of the system very difficult. Setting up a centralized server is so difficult because the intermediate server technology is different depending on the platform. The majority of development was done using Apple's Mac OSX and the centralized server hosting the solution with the MySQL database is linux based. The Adobe Flash Builder web development platform must also be licensed to be used, even in an educational setting, for longer than 60 days. In order to provide useful visualizations in our application without unnecessary development overhead, being able to utilize javascript libraries is of primary importance.

The Web2Py framework removes the fundamental server and development

issues encountered using the AFB framework. The Web2Py framework is a web server with Python as a backend technology, instead of PHP (as is the case with Apache2), or instead of .NET (as is the case with Microsoft IIS). The Web2Py framework also allows for the use of all current web technologies to be used separately or in conjunction with python. The current web technologies now being used for implementation are CSS3, HTML5, and jQuery (javascript). The Web2Py framework is extremely easy to setup for Windows, Linux, and MAC operating systems. The Web2Py framework is open-source software that has been under constant development since 2007. One of the major development difficulties encountered with the AFB framework was not being able to use javascript visualization libraries. In order to make the final changes (additional versions of the group view) to EngageMe suggested by teachers, these libraries that offer descriptive APIs for visualization functions is fundamental.

A full implementation of EngageMe has been completed using the Adobe Flash Builder (AFB) framework. This AFB implementation includes the following pages/functionality: login, class loading, group view, individual view, and data management for digital information. Screenshots of the group and individual views are listed earlier in this chapter. Screenshots of the other pages, with a more complete explanation of each, follow. The Web2Py framework implementation, that is in progress, currently has a subset of the functionality offered by the AFB implementation. The Web2Py implementation includes the listed pages/functionality: login (figure 3.7), class loading (figure 3.8), group (figure 3.9) and individual (figure 3.10) views.



EngageME™

Welcome to EngageME! x

EngageME

for Reflective Classroom Understanding

Login

User ID

User Name

Password

Submit

Copyright © 2015

Powered by [web2py](#) and [SOLO Tech](#)

Figure 3.7: EngageME: Web2Py Login

EngageME™

Please select options to load a class. ✕

EngageME

for Reflective Classroom Understanding

Welcome Amy McNelis

Grade

8

Subject

810 Honors Language Arts

Date

2014-10-06

Load Class

[Data Entry](#)

Figure 3.8: EngageME: Web2Py Load Class

EngageME™

View Class

Instructor Amy McNelis

Subject Honors Language Arts

Today Fri Apr 10, 2015 12:50:44

Class Date Mon 06 Oct 2014

Grade 8

View the interest levels of the students in your class. x

Load

Logout

left front

right front

|           |           |           |           |          |
|-----------|-----------|-----------|-----------|----------|
| Akshit P  | Alexan St | Alex Da   | Alex Wa   | Arjun Sa |
| Caiti St  | Carter Be | Emily Ma  | Ishani D  | Jim Su   |
| Kenned Ca | Maddie De | Meghan Br | Peyton Da | Reid Zi  |
| Stutie B  | Stuti S   | Sydney Rh | Trey T    |          |

0:00:02 / 1:15:45

Figure 3.9: EngageME: Web2Py Group View

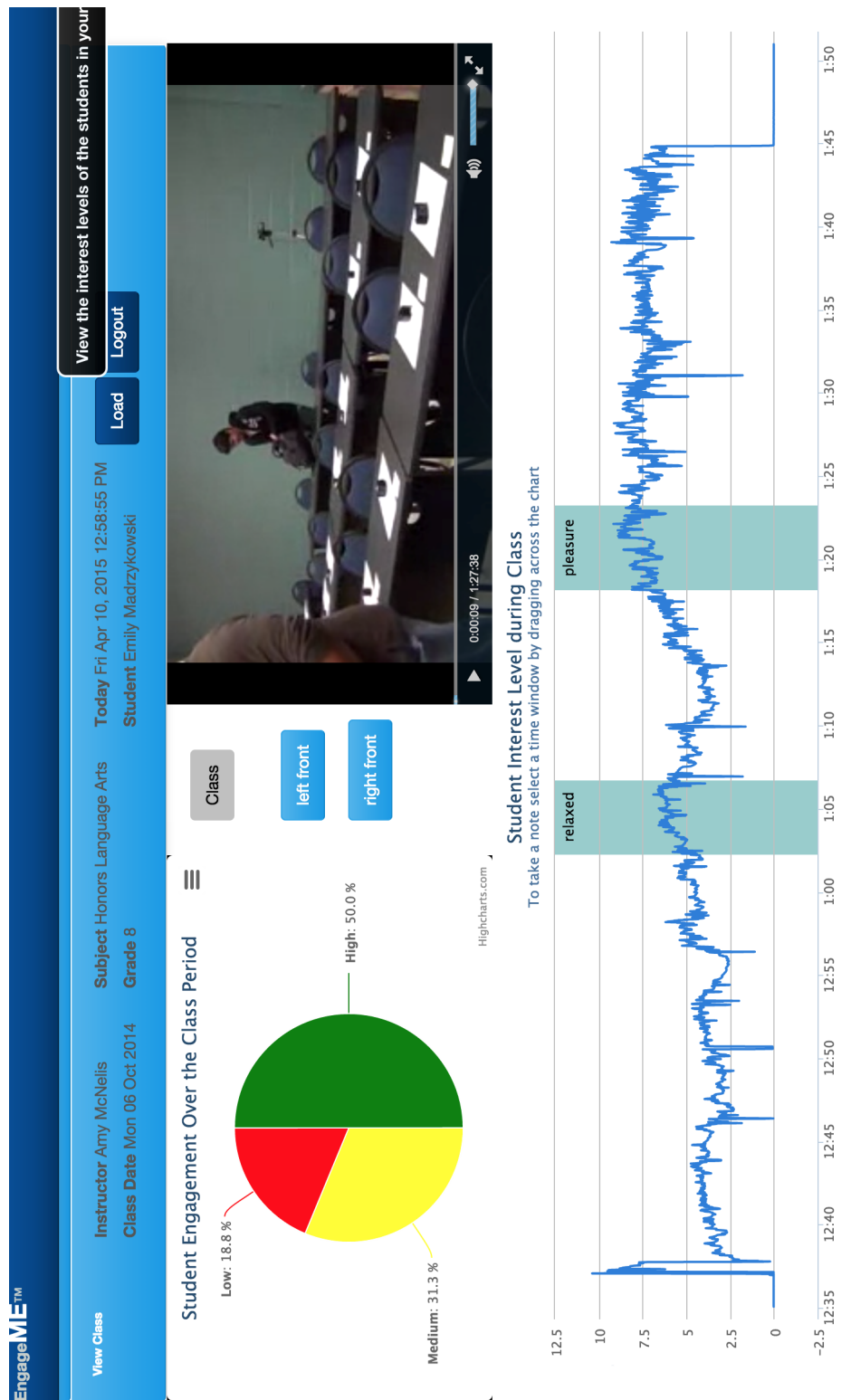


Figure 3.10: EngageME: Web2Py Individual View

The EngageME frontend has three major functionalities: display classroom-level engagement information with video (figure 3.4), display individual-level engagement with video (figure 3.5), and allow easy data input (figure 3.11). Both functionalities that display engagement will come with an added ability for the instructor to make notes about the engagement information at any point in time; this added bonus is aided by video playback.

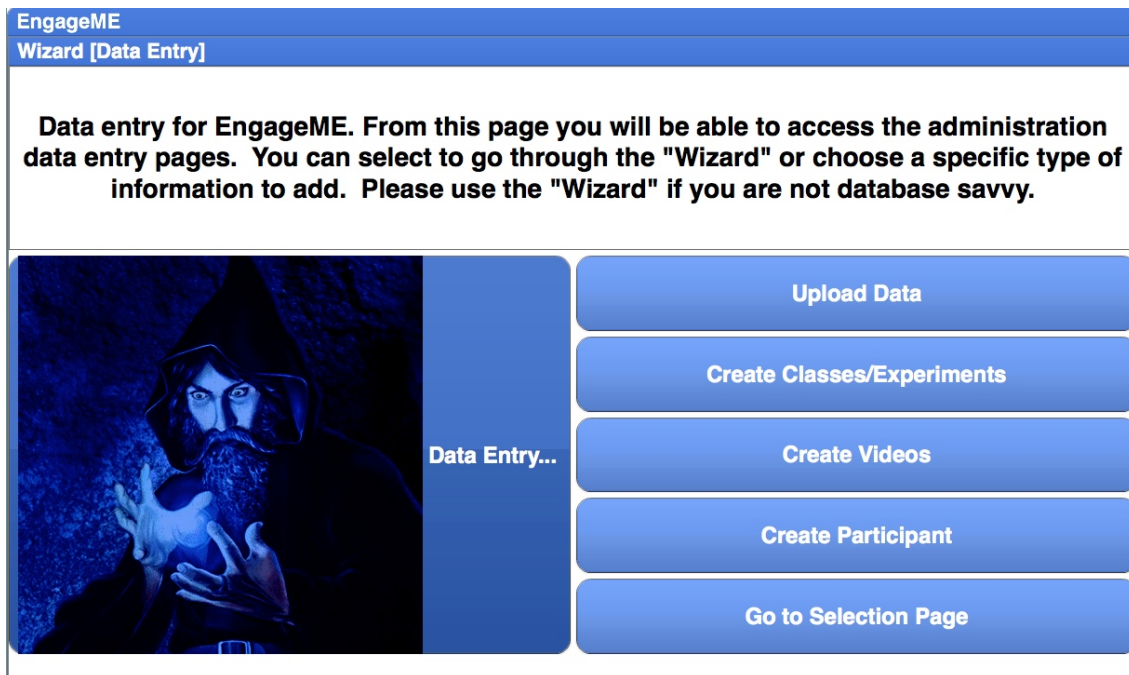
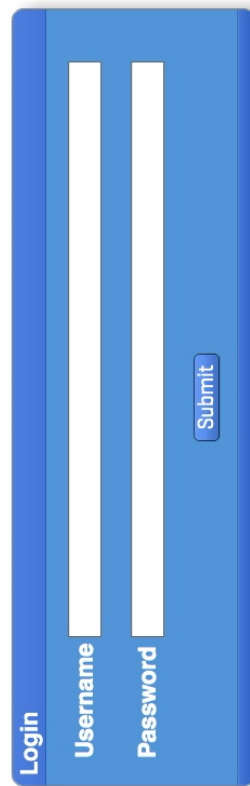


Figure 3.11: EngageMe: Data Entry Wizard

After login (figure 3.12) you are taken to the load page (figure 3.13). The load page includes interactive class selection dropdown menus and buttons that allow a user to either load class information or enter data.



A blue login form with a white border and a shadow. The form contains the following elements:

- Login**: A label at the top left of the form.
- Username**: A label above a white text input field.
- Password**: A label above a white text input field.
- Submit**: A blue button with white text located to the right of the password field.

Figure 3.12: EngageME: Login

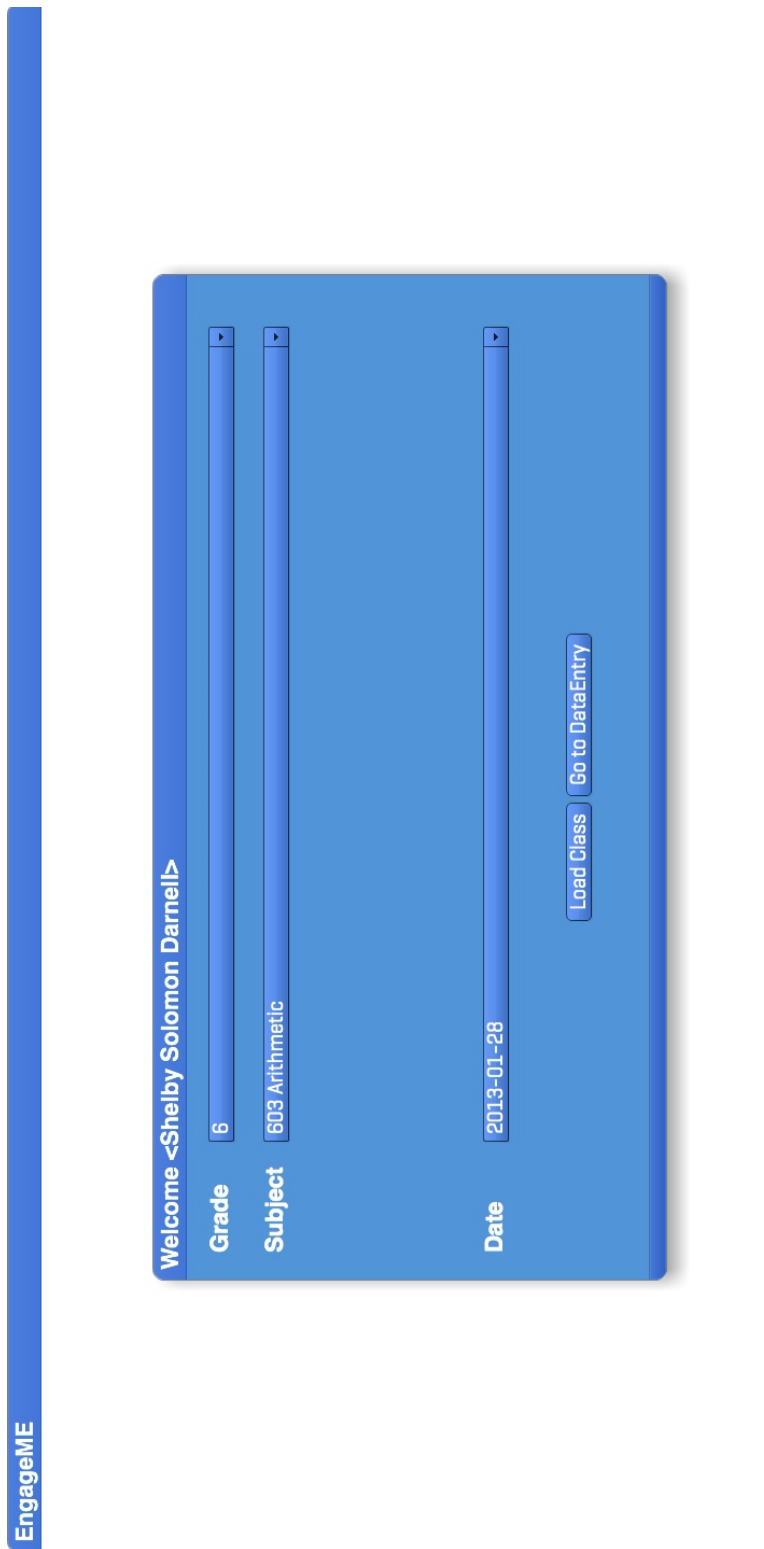


Figure 3.13: EngageME: Load Page

The data input for the system includes several separate upload and description pages for different types of information. The first of the data entry pages is for uploading video and EDA files, as seen in figure 3.14. This page allows an administrator to select an EDA file, associate it with a participant and upload it to the database. The class entry page (figure 3.15) allows an admin to define a new class (e.g. grade level = 7, class name = Math, teacher = teacherid).

**EngageME**  
**Upload [Data Entry]**

**Back** **This is the page where you upload data.** **Next**

**Videos**

class, http://127.0.0.1:8888/flex/videos/cl  
class, http://127.0.0.1:8888/flex/videos/d  
class, http://127.0.0.1:8888/flex/videos/fa  
class, http://127.0.0.1:8888/flex/videos/g  
class, http://127.0.0.1:8888/flex/videos/k  
class, http://127.0.0.1:8888/flex/videos/k  
class, http://127.0.0.1:8888/flex/videos/k

**Browse for Video**  
Select Video Type  
experiment

File to upload:  
eex771\_20130124\_video.mp4

**Upload Video File**

**Add Video Description**  
yes

**EDA Entries**

{SensorID: 017k, Begin Time: Wed Feb 2  
{SensorID: 018k, Begin Time: Wed Feb 2  
{SensorID: 017k, Begin Time: Fri Feb 22  
{SensorID: 018k, Begin Time: Fri Feb 22  
{SensorID: 018k, Begin Time: Thu Feb 2  
{SensorID: 017k, Begin Time: Thu Feb 2  
{SensorID: 018k, Begin Time: Thu Feb 2

**Browse for EDA**

Figure 3.14: EngageME: Data Upload



EngageME

Class [Data Entry]

Back

This is where the class or research group name are created.

Next

Clear Filters

| Current Classes  | Filters | Class Name | Teacher |
|--|---------|------------|---------|
| [601] English/Language Arts taught by drboss for 6 in 2012 | Year    | 801        | drboss  |
| [701] English/Language Arts taught by drboss for 7 in 2012 |         |            |         |
| [801] English/Language Arts taught by drboss for 8 in 2012 |         |            |         |

Grade

Subject

English/Language Arts

Teacher

Subject

Grade Level

Year

English/Lang...

8

2012

Submit to Database

Figure 3.15: EngageME: Data Entry Class

The video entry page (figure 3.16) allows an admin to upload video to the server assign it to a specific class. The participant entry page (figure 3.17) allows an admin to define a new participant and assign them to a class and teacher.

EngageME

Video [Data Entry]

Back

This is the page where you add a video.

Next

Available Videos

center front, http://127.0.0.1:8888/flex/videos/koop\_wakinghour.mp4

center front, http://127.0.0.1:8888/flex/videos/chronocross.mp4

center front, http://127.0.0.1:8888/flex/videos/fallingawayfrom.mp4

center front, http://127.0.0.1:8888/flex/videos/gasarakl.mp4

center front, http://127.0.0.1:8888/flex/videos/koop\_euphoria.mp4

left front, http://127.0.0.1:8888/flex/videos/viewa\_201202210752.mp4

center front, http://127.0.0.1:8888/flex/videos/soujirou.mp4

center front, http://127.0.0.1:8888/flex/videos/dontspeak.mp4

center front, http://127.0.0.1:8888/flex/videos/morena.mp4

Location

http://127.0.0.1:8888/flex/videos/koop\_euphoria.mp4

Class ID

603 Arithmetic

Video Type

class

View Type

center front

Begin date/time

2013-01-25 13:00:00

Duration

2:30:00

Video Description

temp video for demo

Submit to Database

Figure 3.16: EngageME: Video Info Entry

EngageME

Participant [Data Entry]

Back

This is the page where you add a participant.

Next

| Identification | Last Name | First Name | Other Names | Participant Type | Sensors and Times  | Class |
|----------------|-----------|------------|-------------|------------------|--|-------|
| boonejd        | Deborah   | Jennifer   | Boone       | student          | [601] English/Language Arts taught by drboss for 6 in 2012<br>[602] Social Studies taught by drboss for 6 in 2012<br>[603] Arithmetic taught by ssdarnell for 6 in 2012<br>[604] Reading taught by ssdarnell for 6 in 2012<br>[605] Physical Education taught by ssdarnell for 6 in 2012<br>[606] Wood Shop taught by ssdarnell for 6 in 2013<br>[613] Arithmetic taught by drboss for 6 in 2012<br>[701] English/Language Arts taught by drboss for 7 in 2012 |       |

Add Information

Remove Information

{SensorID: 018k, Begin Time: Fri Feb 22 13:42:25 GMT-0500 2013, End Time:  
 [605] Physical Education taught by ssdarnell for 6 in 2012

Submit to Database

Figure 3.17: EngageME: Participant Info Entry

# Chapter 4

## Privacy and Trust

### 4.1 Research Question 2

What are the barriers for adopting physiology-based technologies in the classroom?

### 4.2 Study Context

In the midst of our participatory research with teachers, a blog post <sup>1</sup> was released about one author's opinion of the research. Unfortunately, the post was based on a mistake on a website connecting our efforts to empower teachers and students to understand engagement with another study trying to understand teacher effectiveness. The interpretation of this work in the blog post was, in effect, that the arousal levels of students would be utilized as a way to evaluate, and possibly fire, teachers. Even though the post, which generated hundreds of responses, was based on inaccurate

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<sup>1</sup>Our effort here is not to critique or refute this blog post. In an effort to focus on the privacy and trust topic of the paper and to avoid igniting further discussions of the blog post, I have purposefully chosen not to name the author and source of the post.

information, the resulting perceptions of the project are valid and informative of the views people might develop about a pervasive affective computing system. Therefore, the post provided an opportunity, beyond the efforts in the participatory research with teachers, to examine the proposed affective computing system critically.

### 4.3 Data Sources

We have three main data sources: focus groups, online news articles, and social media sites. Our twenty-four participants in the focus groups have been divided into two cohorts: teachers and district administrators. The first cohort consists of ten sixth through eighth-grade teachers and a principal from a middle school the Southeast who teach English, science, social studies, and mathematics. All participants are white females with one to fourteen years of experience teaching who responded to a general request from their principal asking if they would be interested in participating in the study. They had no knowledge about the details of the study; so there should not have been a bias towards teachers who were more accepting of affective computing. The second group consists of various administrators from the school district including two principals, a professional development specialist, a responsiveness to instruction specialist, a high school instructor, a professor, and a project executive director.

Our focus groups were divided into three sessions held with each cohort. Consent forms were given to each group and participants were given the opportunity to opt out of participating. During the first session, we first introduced stakeholders to electrodermal activity as a measure, as well as the sensors for measurement. Next, we provided background for the goals of the project and familiarized ourselves with the ways in which they try and understand how their students are engaged in the classroom. We also asked questions related to the gaps they see inherent in their ap-

proach and how they could imagine improvement. In addition to field notes collected by a research assistant, we collected drawings from stakeholders to understand how an affective computing system might look. During the second session, we presented a paper-based prototype developed as a result of the previous discussion and asked for feedback and improvements. During three different focus group sessions held thus far, two with the teacher cohort and one with the administrator cohort, field notes were generated from discussions.

The remainder of our sources consist of online news articles and social media sites ( $n = 522$ ) containing articles written in response to a blog post reporting inaccurate information about the work. These sources were found using the Social Media Listening Center at Clemson, which uses Radian6 technology to filter relevant articles and posts dealing with the topic. Radian6 is a social media monitoring platform that gathers data, in part, from Facebook, Twitter, blogs, blog comments, message boards and online forums, news groups, podcasts, reviews on e-commerce sites, experience sharing sites, and mainstream news sites. In order to accomplish this task, a filter was created for terms in the initial blog post for a one-month time period that included the initial blog post.

## 4.4 Analysis

An initial analysis of the focus group and social media data consisted of computing percentages for positive, negative, and neutral sentiments. Focus group and social media data were coded by two raters as positive if the poster expressed clear agreement with the technology, discussed beneficial implications, or provided positive suggestions; coded as negative if the poster used profanity, totalitarian references, expressed anger, disgust, fear, or resentment; and neutral if remarks were indefinite

(i.e., forwarded online article or no valanced opinion presented). Finally, an interrater reliability analysis was performed to determine agreement between raters.

Next, thematic analysis was utilized to generate themes from the focus group notes and online data. Thematic analysis is “an accessible and theoretically-flexible approach to analyzing qualitative data” [13]. This method, widely used in psychology, calls for the demarcation of a qualitative data corpus into themes. Thematic analysis is valuable when attempting to understand a data corpus whose information is based on notes from study groups and blog posts with comments, in other words, data that were not collected under experimental conditions. All data were also analyzed using thematic analysis procedures which include building familiarity, generating codes, identifying features, finding, confirming, and defining themes for reporting [13]. The focus group and social media data presented separate themes after analysis and are explained in detail in the next sections.

## **4.5 Results**

### **4.5.1 General Sentiments**

Table 4.1 depicts the positive, negative, and neutral sentiments found in the online news articles and other social media. Positive sentiment is shown by expressing clear agreement with the technology, discussion of beneficial implications and providing positive suggestions or improvements to the design and functionality of the system. Negative sentiment is shown by using profanity when commenting on the system, suggesting the system is totalitarian, and expressing other negative emotions in reference to the system. Neutral sentiment is asking non-leading questions and making flatly factual statements about the system. Two coders rated sentiment for

the focus groups and social media data. Disagreements and revisions were handled as outlined by Lampert and Ervin-Tripp in chapter seven of “Talking data: transcription and coding in discourse research” [24]. The focus group data was found to have no negative sentiment. The social media data included news articles, tweets, Facebook posts and comments from each of those media sources. After removing virtually all of the retweets, we had 254 separate entries from social media. The coders agreed 135 of those entries were neutral. In reporting the findings and agreement between the coders we report with and without neutral sentiment for the social media sources. We report without the neutral entries because a lot of the neutral entries were from news articles reporting strictly facts. The interrater reliability for the focus group data was 97.9% with a Cohen’s kappa of 0.98, virtually perfect agreement. The interrater reliability for the social media data, without agreed upon neutral entries, was 92.3% with a Cohen’s kappa of 0.66, indicating substantial agreement. The interrater reliability for the social media data, with neutral entries, was 81.5% with a Cohen’s kappa of 0.64, indicating substantial agreement[62].

Table 4.1: Sentiment Analysis Results

| Group Type           | % Negative | % Positive | % Neutral |
|----------------------|------------|------------|-----------|
| Focus Groups (n=96)  | 0%         | 86.5%      | 11.5%     |
| Social Media (n=78)  | 83.3%      | 9%         | excluded  |
| Social Media (n=254) | 25.6%      | 2.8%       | 53.1%     |

## 4.5.2 Results - Social Media Themes

**Theme One.** Many of the authors and commenter’s believe that this project is just another effort to control aspects of citizens private lives. The name “Big Brother” (a totalitarian dictator from George Orwell’s novel entitled Nineteen Eighty-Four) [56] was commonly used. One author posted, “It is not too far of a stretch to assume that



tracking bracelets could one day be used to weed out students or teachers that do not buy into agenda[s], by monitoring what is being taught and how students respond to it, Big Brother could theoretically read the human mind in real time, which has some fairly disturbing implications.”

**Theme Two.** The second theme was that the technology was being used to evaluate teacher performance. Authors thought the technology would be used to evaluate teachers rather than help and empower the classrooms. One author posted, “Using students’ emotional responses to various learning material as a metric of how well a teacher is performing is a flawed approach that could send many quality, veteran educators packing their bags.” Another author posted, “A student’s physical reaction to a classroom lesson soon could be used to judge how successful or unsuccessful an educator is in keeping students engaged.” Lastly, an author suggested, “The student reactions recorded on the bracelets’ sensors could be added to a host of more traditional teacher evaluation methods such as test grades, administrator observations, and student surveys.”

**Theme Three.** Many believed that the technology would not be able to distinguish what is actually engaging a student. In other words, the technology would not work. One poster wrote, “In any case, even if a child is giving off highly engaged skin signals, how would the machines know whether he or she is deeply engaged in a beautiful daydream rather than 14th-century English literature?” Another author asked a similar question, “How would the bracelet tell if a student is responding to a teacher and not to something his friend whispers in his ear?” Authors and posters also cautioned at the fact that people can be deceptive. One poster maintained, “It’s a fair point, but in terms of the GSR’s actual effectiveness, there’s one thing

researchers should bear in mind: Children are very, very good at cheating.”

### 4.5.3 Results - Focus Group Themes

**Theme One.** The first of the focus group themes was *informative feedback*. Generally, the teachers and administrators expressed desires for the engagement pedometer to provide information that would help them adjust their lesson plans. One teacher insisted the technology should Alert teachers of low levels of engagement, so teachers can monitor or re-engage students.” Another said, “For lessons [the technology should tell] if the teachers consistently have low engagement or high engagement at specific points in the lessons.” Some teachers wanted the information from the tool as a reflective feature while others wanted real-time information, or as one teacher stated, “Instruction intervention as class proceeds.”

**Theme Two.** The second theme was the teachers having the option of using the pedometer to view individuals or groups within the class. One teacher asked to be able to “Target particular students upon request.” Some teachers insisted that since class is not always individual work, this would be helpful. One teacher said, “Can each student’s dots [points representing students] also have a number so we can track, if we move from individual to pair to group work?” Some teachers also expressed the desire to observe patterns and behaviors of students over time. One teacher suggested “A way to follow a particular student through lessons, class schedules, and four-week periods as a way of tracking progress/engagement.”

**Theme Three.** The third theme was the desire to have access to data immediately for interpretation. Some teachers expressed that they wanted the data to come straight to different devices they have such as iPads or other mobile devices. One

teacher maintained, “I would want data immediately to my PC or other device so I could access it to be able to adjust instruction and monitor students/groups.” In relation to Theme One, rather than having an alert for feedback, teachers want to interpret the data themselves. One teacher explained that it would be useful if “Each student [was] able to be monitored and the teacher [was] able to see live data to use immediately to be able to intervene and instruct in a different way to benefit all students.”

## 4.6 Discussion

In this research, there is an obvious discrepancy between sentiments expressed between the two data sets. Most focus group participants found the idea amenable to use in classes and provided suggestions on the design of the tool. All the themes from the focus groups were about aspects they wanted in a tool to augment their own abilities to support students in their classrooms. Twice ideas were expressed around who would be in control of the data and what the possible negative uses of this information were. This general positive sentiment, of course, can be attributed to how the information was presented to these groups. In the focus group sessions, we presented the technology, described its limitations (e.g., noise and attribution errors), discussed opportunities to opt into the research, and asked for teacher input. Although we asked for both feedback and concerns (i.e., should this be developed at all), this approach did not espouse the same number of negative reactions as the blog post. The results confirm previous suggestions presented in the Introduction about privacy and trust of pervasive computing systems. First, public awareness of accurate information is crucial. Developers of pervasive affective computing systems must make sure that people understand the ins, outs, and limitations of what is being developed.

The challenges associated with the interpretation of electrodermal activity are an important limitation that must be discussed when presenting the current system. Second, who has access to data and how they will be utilized is important. In this case, steps must be taken to prevent the technology from being used to evaluate the teacher. Rather, this system can be used by the teacher to help him/her understand better how students are responding to his/her pedagogical approach. The student, of course, cannot be forgotten in this picture. Although the technology has been framed for empowering the teacher, the system should not be used to evaluate the student either. Instead, it can be used to facilitate teachers' understanding of their impacts on students so they can be better supported. In addition, it can be used by the students to understand their own engagement. Finally, Ackerman [19] defines privacy as "the ability of an individual to control the terms under which their (sic) personal information is acquired and used". In order for systems to be respectful of teachers' and students' choices, opportunities must be provided to opt in, or out, at any moment. For our technology, teachers and students should have the choice about providing their engagement data to the system.

## 4.7 Limitations

The main limitations are the scope of analysis and biases. The scope of analysis limitation deals with the number of responses from the focus group compared to those from social media. Due to the uniqueness of the situation in which the data for study was collected, there is no readily available database containing similar information from which to draw themes. The number of data points for the focus group is twenty-four, while the number of data points for social media is five hundred twenty-two. Another limitation is how each group was introduced to the topic. The

focus group was introduced to the topic by researchers whose intentions are to build a tool to enable teachers to improve classroom experiences, while the social media group was introduced to the topic by a blog post that did not accurately represent the work. These disparate introductions impacted how the discussions proceeded. Finally, biases exist for interpretation of the sentiments. After performing the coding for the social media group, the two coders had moderate to substantial, instead of strong agreement. Even with definitions in place for the coding scheme, what we as researchers see as positivity and negativity can still differ.

# Chapter 5

## Exploratory Case Study

### 5.1 Research Question 3

The study is meant to provide insight into two questions:

1. To what extent do the teachers find the system usable and useful?
2. How do teachers use the system?

Improving student engagement through teacher reflective practice is the focus. Moving toward this goal we need to evaluate the usability and usefulness of the system built to aide this endeavor. The system, EngageMe, is meant to aide a teacher's reflective practice, helping them focus on aspects of student behaviors that are not easy to evaluate in the busy and very active classroom environment.

### 5.2 Study Design

We have utilized an exploratory case study design. Exploratory case studies are used when the investigator cannot manipulate the actions of the participants

and when there is a need to cover the contextual condition of a teacher instructing students in as close to a normal classroom setting as possible. Yin [75] outlines four reasons to use a case study in research: (a) the focus of the study is to examine “how” and “why” questions; (b) the behavior of those involved in the study cannot be manipulated, (c) you want to cover contextual conditions because they are believed to be relevant to the phenomenon under study; or (d) the boundaries are not clear between the phenomenon and context. A case study does not discount the views of the participants in the study, but also allows for a level of objectivity in evaluation and analysis. Yin’s views on case studies are based on a constructivist view of truth being relative and dependent on one’s perspective [6]. Yin further explains an exploratory case study is to be “used to explore those situations in which the intervention being evaluated has no clear, single set of outcomes” [75]. EngageMe’s use of teacher notes and surveys place importance on the perspective of the study participants; while the recording of video and physiological information provide objective information off of which to understand classroom engagement.

## **5.3 Methodology**

### **5.3.1 Participants**

The study took place at a middle school serving grades 6-8 with approximately 1,537 students in the southeastern United States. In this school, 15.1% are African American, 61.7% are White, 7.9% are Hispanic (non-White), and 15.3% are Asian or other. Further, 17.9% are on free and reduced lunch programs. Three classes, all with White, female teachers, within this school participated in this study. Two of the classes, the 6<sup>th</sup> grade Language Arts and 8<sup>th</sup> grade Honors Language Arts, were

observed for three days: Monday, Wednesday and Friday. The 7<sup>th</sup> grade Math class was observed for two days: Tuesday and Thursday. Each class consisted of a different grade level and subject as outlined in Table 5.1.

Table 5.1: Class Information

| Teacher | Subject              | Grade Level | Males | Females | Total |
|---------|----------------------|-------------|-------|---------|-------|
| A       | Language Arts        | 6           | 9     | 16      | 25    |
| B       | Honors Language Arts | 8           | 14    | 19      | 33    |
| C       | Math                 | 7           | 5     | 9       | 14    |

### 5.3.2 Ethical Considerations

All proper forms and procedures were followed to protect the privacy and ensure the ethical correctness of our study. First, we received IRB approval from our University. Second, we received approval to perform the study from the school district. Finally we garnered cooperation, with signed consent, from the specific school principal, teachers, parents and students who would be a part of the study.

### 5.3.3 Procedures

The study consists of two distinct parts over the course of six days: in situ classroom data collection and reflective teacher note-taking. During the first five days, physiological data and video were collected from 72 students and 3 teachers. The sixth day was dedicated to collecting teacher notes in the system and having them fill out surveys. On the sixth day, the teachers used EngageMe for reflecting on student engagement in the classroom.

Classroom observation was most involved the first day of the study. The observation consisted of recording video of the class as students wore physiological



sensors. The first day included the distribution and collection of a pre-class survey for the students along with explaining the study. The students are given approximately five minutes to complete the survey before being collected by the researcher. The survey the students were given takes questions from the High School Survey of Student Engagement (HSSSE) developed at Indiana University [74]. The pre-class survey was collected before the teacher begins her lesson. All other steps taken to prepare for classroom observation data collection for the rest of the first day and the other days are the same. Upon entering the class the cameras were setup to best capture as many students as possible. After camera setup, sensors and sanitizing hand wipes were placed on each participating students' desk. The students used the hand wipes to clean their wrists before wearing the sensors. After turning on the cameras and handing out sensors, the researcher left the room and came back at a time specified by the teacher. At this time, the post-class surveys were handed out and students were instructed to remove the sensors. While students were filling out the post-survey, the researcher collected the cameras and the sensors. After approximately five minutes the post-class surveys were collected.

After these five days of classroom data collection, the video was split, cut, encoded and recombined before being added to the system. The student data from each of the approximately 32 sensors was uploaded into the system. Each video was downloaded from our cameras onto a research laptop. Each video was re-encoded to reduce the video file size to minimize load times during system loading. The cameras were set to break recorded videos into thirty minutes chunks. The researchers used open source software FFmpeg [30] to combine the disparate video chunks. There were no encoding or video concatenation errors recorded for any of the videos used in the study. Once all class videos and sensor datum were placed in the system, the school was visited again so the teachers could use the system.

On day six, the teachers used EngageMe to reflect on classroom activities. Of note, consensus amongst the teachers was a view of engagement as a mixture of cognitive and behavioral components. The teachers stated an engaged student was one that stayed on task, either by focusing on their own work or asking questions and participating in group activity that led toward task completion, during a class period.

Teacher reflection and note taking began with an explanation of the system followed by an issuance of each teacher's system user name and password. Teachers were instructed to take around ten notes for each class period reviewed. As a teacher reflected on her classroom instruction and her students, the researcher stayed close by to answer any questions the teacher may have about the system. Initially thirty minutes was allotted for teacher reflection; however, each teacher spent approximately an hour reviewing and taking notes in the system. After reflection and note taking the teachers were asked to fill out the system usability scale (SUS), a modified standardized user experience percentile rank questionnaire (SUPR-Q), and the EngageMe system survey. The teachers spent no more than fifteen minutes filling out the surveys.

### **5.3.4 Measures - Electrodermal Activity (EDA)**

Electrodermal activity (EDA) is the main physiological measurement utilized in this study [12]. The regulation of physiological states of arousal is supported by balanced activity within the sympathetic and parasympathetic divisions of the autonomic nervous system. The sympathetic nervous system (SNS) and parasympathetic nervous system (PNS) are often likened unto the gas and brakes of a car respectively; aiding "fight and flight" versus "rest and digest" activities. While the SNS prepares

the body to act on changing environmental conditions by accelerating heart rate, constricting blood vessels, and raising blood pressure, the PNS dilates blood vessels leading to the digestive tract, stimulates salivary glands, and constricts the bronchioles of the lungs. As SNS activity increases, sympathetic fibers that surround eccrine sweat glands modulate the production of sweat. The skin, in turn, momentarily becomes a better conductor of electricity (i.e., electrodermal activity) [60, 65]. EDA is at times referred to as galvanic skin response (GSR).

EDA by itself is not enough to show engagement. Further, numerous events such as pain, significant thoughts (not related to the current context), lying, exercise, individual changes in biochemistry, and motion artifacts can lead to changes in the skin's activity. Even with attribution and noise limitations, however, electrodermal activity is a useful measure that has been used in research focusing on stress and anxiety [29], lie detection [58], user interface evaluation, empathy [47, 46] and game assessment, and seizures [59].



Figure 5.1: Q Sensor

The Q sensor [1] (figure 5.1), was chosen to collect skin conductance, temper-

ature, and motion data since this sensor can be worn outside of a laboratory setting (i.e., without being tethered to a computer) and since it is worn on the wrist like a watch, which might increase the possibility of it being unobtrusive to the student. This sensor provides information about a person's level of arousal provided that other triggers of increased perspiration have been held constant (e.g. temperature). The sensor will not provide any information as to the specific emotion that is being elicited unless other conscious emotion variables are collected. Once collected, the sensor is tethered to the computer and the information is downloaded.

### 5.3.5 Measures - Surveys

Three pre-existing surveys were found that measure usability, usefulness, and technology acceptance. The system usability scale (SUS) measures system usability. The second is the standardized universal percentile rank (SUPR-Q), which provides an alternate measure of usability, but also measures credibility, loyalty and appearance [66]. Finally, the technology acceptance model (TAM) questionnaire consists of two parts: ten questions to measure usefulness, and ten to measure ease of use. Each of these surveys will be explained in more detail below.

The system usability scale (SUS) is a survey that has been used for almost twenty years to measure a system's usability [15]. This survey is comprised of ten statements and uses a five-point scale, ranging from *Strongly Disagree* to *Strongly Agree*, for scoring. In [5], Bangor, Kortum and Miller create an adjective scale to go along with the calculated SUS score. The SUS adjective scale, seen in figure 5.2 contains the ratings: worst imaginable, awful, poor, okay, good, excellent, and best imaginable. Bangor et.al. append percentile and adjective scales alongside the SUS normal scale to help communicate usability.

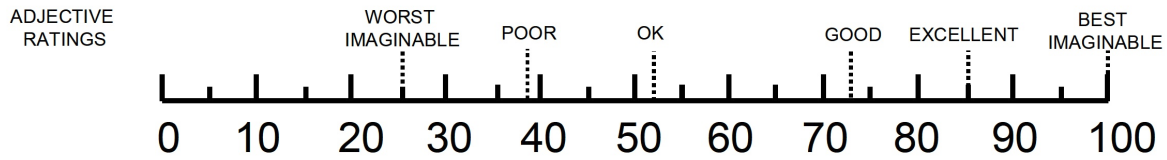


Figure 5.2: SUS Adjective Scale

The SUPR-Q survey was modified because there are some questions that were not applicable for our study. The SUPR-Q consists of four factors: usability, trust and credibility, appearance and loyalty. The credibility factor is normally calculated using five questions, but they were about purchasing, business and promises. EngageMe makes no promises to the user, does not have purchase functionality and is not a site on which business is conducted; hence, questions related to these secondary factors were removed from our survey. Two factors were added to our version of the SUPR-Q: usefulness and engagement. The usefulness questions were inspired by the technology acceptance model (TAM) introduced by Davis [22]. Davis' TAM survey questions require measurement over time, so the normal ten questions concerning usefulness were reduced to three. The usefulness questions were pulled from the TAM survey. The TAM uses a seven point scale (ratings from “strongly disagree” to “strongly agree”). The SUPR-Q and TAM surveys were not used explicitly in the way in which they were designed, but used as question banks that can give us more direction on how to improve our study and system based on participants' answers. The second survey was given to all participating teachers provides a sense of the usefulness of the system. It included the questions about their engagement understanding. The questions are: 1) a 7 point Likert scale which indices from 'Strongly Disagree' to 'Strongly Agree': This system has changed my understanding of student engagement. 2) Essay: If the system has changed your understanding of student engagement, please explain how.

## 5.4 Results

### 5.4.1 System Usage

EngageMe has the following interactive functionality: video skipping, view changing and note-taking. Video skipping is possible on both the group and individual views. On the group view, video skipping is accomplished by moving the progress bar at the bottom of the page or on the video player. On the individual page, video skipping is accomplished by clicking on the line graph or by moving the progress bar on the video player. When the video is skipped, the system adjusts to the modified time and pulls physiological information from the database for the new time. Video skipping is so important because it allows the users to view class video during intervals of interest instead of having to watch the video in its entirety. Table 5.2 shows how many times each teacher skipped through the video and how many notes each teacher took on each day. Of note, Teacher A skipped through the video more than twice as much as either of the other teachers.

EngageMe goes through the EDA data from each student over a class period and calculates high, medium and low arousal in five minute intervals. We expected the teachers to use the arousal levels to inform note taking. We expected teachers to take notes when student arousal rises about the level calculated as low. We found that 51% of the notes were taken during low student arousal, 19% during medium arousal, and 30% during high arousal.

Table 5.3 gives a count of how many notes each teacher made at each level of student arousal. The last eight notes taken by teacher were made when the system reported low student arousal. Teacher B's notes oscillated between each level of student arousal throughout her note taking. Eleven of the first twelve notes taken by teacher C are during low student arousal, afterward her notes oscillate between

Table 5.2: System Usage Information

| Teacher | Day of Class  | Video Skips<br>(How Many) | Notes |
|---------|---------------|---------------------------|-------|
| A       | Oct. 6, 2014  | 60                        | 7     |
|         | Oct. 8, 2014  | 32                        | 6     |
|         | Oct. 10, 2014 | 14                        | 11    |
|         | <b>Total</b>  | 106                       | 24    |
| B       | Oct. 6, 2014  | 12                        | 8     |
|         | Oct. 8, 2014  | 3                         | 7     |
|         | Oct. 10, 2014 | 17                        | 4     |
|         | <b>Total</b>  | 32                        | 19    |
| C       | Oct. 7, 2014  | 9                         | 15    |
|         | Oct. 9, 2014  | 31                        | 10    |
|         | <b>Total</b>  | 40                        | 25    |

Table 5.3: Student arousal when note is taken

| Teacher   | Low Arousal | Medium Arousal | High Arousal |
|-----------|-------------|----------------|--------------|
| Teacher A | 13          | 6              | 5            |
| Teacher B | 8           | 4              | 9            |
| Teacher C | 13          | 3              | 6            |

each level of student arousal. Teacher B is the only teacher that takes more notes at high or medium arousal than low. Based off of five minute intervals of student arousal, students experience high arousal 12.3% of the time, medium arousal 15.4% of the time and low arousal 72.3% of the time. Almost half of all notes taken were during periods of medium to high student arousal.

### 5.4.2 Survey Results

Because of the exploratory nature of this study, our sample size is too small for statistical inferences. However, Table 5.4 presents scores from the survey data

collected. The teachers scored the usability according to the SUS as 42.5, 77.5 and 75 respectively. EngageMe’s average SUS score is 65, which is below the SUS average score of 68, yet EngageMe’s score is not below the level of a usable system. The adjective labels for SUS scores helps with the understanding of the scores. Though Teacher A’s SUS score for EngageMe’s usability was below the average score, it is still an okay score, denoting a usable system. Whereas the scores from Teachers B and C denote the system usability as being good.

Table 5.4: Usability and Usefulness

| Teacher | SUS Score | Adjective | Usefulness    | Usefulness StDev | Engagement Aide |
|---------|-----------|-----------|---------------|------------------|-----------------|
| A       | 42.5      | Okay      | 6 out of 7    | 0                | 5 out of 7      |
| B       | 77.5      | Excellent | 5.67 out of 7 | 1.1547           | 7 out of 7      |
| C       | 75        | Excellent | 5 out of 7    | 0                | 4 out of 7      |

The teachers rated the first of the engagement questions as follows: teacher A 5 out of 7, teacher B 7 out of 7, and teacher C a 4 out of 7. Two out of the three teachers received insights from reflecting on the arousal levels of students in their classrooms, one out of three felt her own beliefs were validated (Teacher C, no agreement or disagreement). The following are the teacher’s essay answers explaining how the system supported their understanding of engagement:

- Teacher A: “Okay, I think this system would be used for teachers observing their students because I learned that the way I see kids is not directly related to the level of arousal. I would love to use this in more detail.”
- Teacher B: “As I said before, engagement can come from many different areas. Unfortunately there is only one me... and 32 buddies.”
- Teacher C: “It helped me see that certain activities were engaging for some students, but not all. It reinforced my thought that not any one thing will



engage ALL students at the same time. I would have like to have been able to see exactly what each student was doing on his/her paper or computer or desk at any given time.”

Teacher C, who gave the lowest response to the engagement question, desired more insight by being able to precisely see what each student is doing. Teachers also made comments about being able to see students arousal levels during class. Teachers wanted to be able to use a tablet and view student arousal so that they may act if a student or students are not interested in the current class activity.

### **5.4.3 Discussion**

Although preliminary, EngageMe is seen as useful and usable, because it offers previously unavailable insight into student classroom behavior to teachers. The average usability rating could have been higher had there been more testing of the system before usage by the teachers. The researchers believe the low score from teacher A is based on the issues she had with the system. More than the other teachers, skipping from one moment to the next kept freezing the system when this teacher tried to view her class. Teacher A’s extraordinarily high video skip rate occurred on the video recording for the first class of hers that was recorded. The cause may have been that the system was used on different platforms, Microsoft windows and Mac OS X. When used on windows (Teachers B and C), the system was less likely to freeze.

Teachers B and C seemed to evaluate the system higher because they didn’t have the same trouble as teacher A. Teacher C who gave the lowest rating concerning whether or not the system changed her understanding of her students’ classroom engagement, had the least number of students in the study. The number of students participating in the study by teacher can be found in table 5.1. Its possible that since

teacher C had less data to view, there was less she could learn about her students. Teachers A & B both had almost twice as many students and one more day of classroom observation and data than teacher C. In other words, the data collected for teachers A& B during the first day is equal to or greater than all of the data collected for teacher C on both days her class was observed. Even with this, teacher C took more notes on her students than either teacher A or B. Teacher C is the teacher who reported not learning something new about student engagement. The number of distinct students each teacher took notes on is as follows: teacher A 17, teacher B 16, and teacher C 9. Teacher C has the least number of students and takes notes on the fewest distinct students; therefore, Teacher C made more notes per student than her peers. It is possible that Teacher C had too little information from which to learn more about her student engagement. It is also possible, since teacher C had the least students participating in the study, teacher C knows all of the students on whom she took notes very well. It is also possible adding another dimension (arousal level) of information to the teachers toolbox was not as informative as expected.

As can be seen in Table 5.2 Teacher A skips the video more than twice as often as the other two teachers. Teacher A had an issue with her first class where performing a video skip made EngageMe freeze. As she was trying to accomplish the goal that was given to her, take approximately ten notes for each day observed, she continued using the system, though buggy. Teacher A rated the usability lowest, which makes perfect sense. Skipping video is a major feature in the software system. In order to take notes and reflect on times in the classroom when students have their interest peaked, being able to skip back and forth through video is a time-saving feature that should be used whenever needed. It is surprising Teacher A's usability rating is as high as it is given a major software feature was hampered.

Looking at table 5.3 we can see that approximately half of teacher notes were

taken when student arousal was not low. Student arousal was low 72.3% of the time during the study. Providing areas of interest by way of electrodermal activity measurements seemed to guide teachers' review of the video and therefore their note-taking. Fifty-five percent of teacher A's twenty-four notes were taken during low student arousal, while the last 8 notes she took were during low student arousal. The other sixteen notes Teacher A took oscillated between all levels of arousal. Eleven of teacher C's first twelve notes were taken during low student arousal, while her other notes oscillated between all levels of arousal. Where it seems teacher A first attempted to take notes where students had higher arousal, teacher C initially didn't use our expected areas of interest to take notes. We expected notes to be taken during periods of medium to high arousal. At some point during the reflective session each teacher, especially teacher B, used times of medium to high arousal to make notes.

One bias the researchers unintentionally added to the system, is found on the individual view of EngageMe. In this view the pie chart has the title, "Student engagement Over the Class Period", while the line graph is titled "Student Interest Level during Class". The pie chart title is incorrect and misleading. During the study this title may have mislead teachers while reflecting on student arousal and intention.

## 5.5 Conclusions

This case study provides preliminary insight into the usability and usefulness of EngageMe as well as an initial understanding of how teachers might use the system. With that said, we want to be able to go beyond the exploratory case study which is meant to export a situation that has no clear single set of outcomes [6]. Based on feedback, our next study will explore if EngageMe can be used to support understanding of engagement and the ways in which teachers might use the system

for decision making.

# Chapter 6

## Lessons Learned

EngageMe is a software system designed, built and tested for improving engagement understanding in the classroom by way of teacher reflective practice. This dissertation chronicles the system from inception through implementation and to an exploratory case study inside a middle school classroom. The research questions for the system come from three different topics: design, privacy and trust, and system usage.

To understand what kind of tool can support teacher reflective practice in the classroom, this dissertation began with an exploration of the concept of engagement and explained the importance of teacher reflective practice. It then presented iterations of the participatory design process that led to the creation of EngageMe. Following this discussion, a study was detailed that bolstered understanding with respect to privacy and ethical concerns. The study found that barriers to using EngageMe in the classroom included distrust of the “real” motivation for recording student physiological information, distrust of the system being used to evaluate teachers instead of empowering them, and doubts of the system being used to evaluate teachers instead of empowering them, and doubts of the technology actually accomplishing the

task set for it. Finally, the use of EngageMe in an exploratory classroom study was undertaken, providing real world data to help us understand the usability and usefulness of our system. Through this study, we preliminarily found that EngageMe is seen as usable, useful and potentially helpful for informing teachers about student engagement. The design, implementation, and evaluation contributions of this work include:

- A participatory process for developing a tool to support reflective practice using electrodermal activity,
- The iterative technical development of EngageMe, a platform for supporting reflective practice,
- Large-scale data collection and analysis that provides insight into the barriers to adoption for this system as well as other monitoring systems in classrooms,
- Preliminary data suggesting the utility and strongest use of EngageMe.

From this completed work, my research group and I have published two conference and one journal article so far:

- Shaundra Bryant Daily, Melva Tonisha James, Tania Roy, and Shelby Solomon Darnell. EngageMe: Designing a visualization tool utilizing physiological feedback to support instruction. *Technology, Instruction, Cognition and Learning* , 2014.
- Shaundra Bryant Daily, Dante Meyers, Shelby Solomon Darnell, Tania Roy, and Melva T. James. Understanding Privacy and Trust Issues in a Classroom Affective Computing System Deployment , pages 414-423. Distributed, Ambient, and Pervasive Interactions. Springer, 2013.

- Shelby Solomon Darnell. EngageMe: A tool to simplify the conveyance of complicated data. In *CHI '14 Extended Abstracts on Human Factors in Computing Systems*, CHI EA '14, pages 359-362, New York, NY, USA, April/May 2014. ACM.

## 6.1 Future Work

The first thing we plan to do is to submit the results from our exploratory case study to the conference on Affective Computer and Intelligent Interactions 2015. The future work for EngageMe falls in two categories: development and studies. Development-wise, EngageMe needs to be improved and added to in three categories: bug fixes, improved features, and mobile development. Bugs which concerned teachers and helped cause low usability valuations need be fixed. As we develop more a more rigorous software engineering process should be followed. EngageMe as it stands now does not have an easily understood interface when uploading data into the system. The system is updated through different pythons scripts instead of a through a GUI element in the web interface. The process of re-encoding and shrinking video is not taken care of by the system, which will prove necessary as it is used beyond our research lab. Beyond the comments teachers made about the engagement and their survey answers, they also expressed a desire to look at student physiological information in real-time, using either a phone or tablet. Incorporating this wireless information transfer between the sensor and system would add another dimension to EngageMe that would make it more useful.

The lessons learned from our studies suggest that this EngageMe might be best situated in a pre-service context rather than integrated into the day-to-day for teachers. For one, the expense of electrodermal activity sensors will not support

scalability of the technology. Further, ongoing concerns over privacy, at least at this time, might overshadow the possible benefits. Although we believe this will continue to shift with the ubiquity of technology and the desires for personalization, utilizing EngageMe as a tool for training teachers might better situate it in a context that's less threatening and reproducible for teachers who are learning their craft.

Why pre-service teachers? The ability to recognize when a student is engaged or when he or she has achieved a state of flow [70] can take time to develop because this ability depends not only on an instructor's observational skills but also on his or her ability to build relationships with students [40, 74]. The tasks of recognizing and monitoring engagement, thus, can prove especially challenging for student and pre-service teachers. Novice teachers, like all teachers, must contend with the stress of working in a multi-task environment [14, 51]. Unlike expert instructors, however, inexperienced teachers have more shallow "wells" of knowledge from which to draw decision-making information; the data they store in working, or short-term memory, tend to be less effectively organized, and their decision making is more labored, leading to longer reaction times [42, 51, 72]. The sum of these conditions results in higher reported levels of stress and increased feelings of being overwhelmed amongst pre-service teachers, relative to experienced teachers [28, 51]. These observations suggest that EngageMe, as long as it displays reliable, easily comprehensible data on student engagement could be a valuable pre-service teacher training tool that might reduce mental workload, stress, and increase expertise in the assessment of engagement. Further studies would include a shift to preservice teachers as well as deepening our understanding of how EngageMe might inform teacher's classroom decisions.



# Appendices

## Appendix A Signed IRB Consent Forms

Information about Being in a Research Study  
Clemson University

**Field Studies for the Development and Deployment of a Classroom Engagement Pedometer  
(Classroom Teacher)**

**Description of the Study and Your Part in It**

Shelby S. Darnell is inviting you to take part in a research study. Shelby S. Darnell is a PhD student of Shaundra Daily an Assistant Professor at Clemson University. The purpose of this research is to develop a technology to support teachers and students in learning what kinds of teaching activities engage students in the classroom.

Your part in the study will be to conduct your classroom activities as normal and then fill out a brief survey indicating how engaged you thought students were with the lesson. You might need to help students adjust or take off the watch-like device they will wear during the course of the study. Finally, we will ask you to videotape yourself conducting the math and English lesson each day of the study. The study will last two weeks (one month). Finally, we will conduct 2-3 focus group sessions in the evening that will last 1.5 – 2 hours where we ask for your opinion on the development of a technology to help you better understand how students are engaging with your teaching.

**Risks and Discomforts**

We do not know of any risks or discomforts to you in this research study

**Possible Benefits**

Through this research, we might be able help you better understand how students are engaging with your teaching.

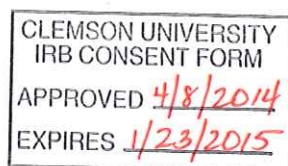
**Incentives**

You will receive \$250 for participation in this study

**Protection of Privacy and Confidentiality**

We will do everything we can to protect your privacy and confidentiality. We will not tell anybody outside of the research team that you were in this study or what information we collected about you in particular.

We might be required to share the information we collect from you with the Clemson University Office of Research Compliance and the federal Office for Human Research Protections. If this happens, the information would only be used to find out if we ran this study properly and protected your rights in the study. We might also be required to share information with the Bill & Melinda Gates Foundation; however this information will be confidential.



We will collect the video data of you in the classroom; however, the video will not be accessed outside of the research team. It will be stored on a password-protected computer. This video will be used to help us understand the teaching practices you are using in the classroom. You will not be personally identified in the video. If we use the video for conference or presentation purposes, your identity will not be revealed.

### **Choosing to Be in the Study**

You do not have to be in this study. You may choose not to take part and you may choose to stop taking part at any time. You will not be punished in any way if you decide not to be in the study or to stop taking part in the study.

If you choose to stop taking part in this study, the information you have already provided will be kept in a confidential manner.

### **Contact Information**

If you have any questions or concerns about this study or if any problems arise, please contact Shaundra Daily at Clemson University at 864-656-5778.

If you have any questions or concerns about your rights in this research study, please contact the Clemson University Office of Research Compliance (ORC) at 864-656-6460 or [irb@clemson.edu](mailto:irb@clemson.edu). If you are outside of the Upstate South Carolina area, please use the ORC's toll-free number, 866-297-3071.

### **Consent**

**I have read this form and have been allowed to ask any questions I might have. I agree to take part in this study.**

**I consent to participation in the survey:**

\_\_\_\_\_ Yes \_\_\_\_\_ No

**I consent to help students if they experience difficulties with the watch-like device:**

\_\_\_\_\_ Yes \_\_\_\_\_ No

**I consent to videotaping the requisite lessons:**

\_\_\_\_\_ Yes \_\_\_\_\_ No

Participant's signature: \_\_\_\_\_ Date: \_\_\_\_\_

A copy of this form will be given to you.



Parent Permission Form  
Clemson University

**Field Studies for the Development and Deployment of a Classroom Engagement Pedometer**

**Description of the Research and Your Child's Part in It**

Shelby S. Darnell is inviting your child to take part in a research study. Shelby S. Darnell is a PhD student of Shaundra Daily, an Assistant Professor at Clemson University. The purpose of this research is to support teachers and students in learning what kinds of teaching activities engage students in the classroom.

Your child's part in this study will be to wear a watch-like device. This device can tell if his/her wrist is sweating more because of something significant he/she sees or hears. It does not read his/her mind, but it can help us understand if he/she is interested in what he/she is doing. We will videotape your child's classroom when he/she is wearing the device, and he/she child will be asked to answer brief questions after a lesson to help us understand how he/she felt about what the teacher did in the class.

It will take your child about two weeks (one month) during class time to take part in this study.

**Risks and Discomforts**

We do not know of any risks to your child in this research study. There is a possibility that the wrist-worn device might be uncomfortable. To minimize this discomfort, it can be adjusted or taken off completely.

**Possible Benefits**

We do not know of any way your child would benefit directly from taking part in this study. However, this research may help us to understand what engages students in the classroom so that we can help improve teaching practices.

**Protection of Privacy and Confidentiality**

We will do everything we can to protect your child's privacy and confidentiality. We will not tell anybody outside of the research team that your child was in this study or what information we collected about your child in particular.

We might be required to share the information we collect from your child with the Clemson University Office of Research Compliance and the federal Office for Human Research Protections. If this happens, the information would only be used to find out if we ran this study properly and protected your child's rights in the study. We might also provide the Bill and Melinda Gates foundation with access to the information that has been collected; however this will not identify your child either.

All of your child's information that is collected will be assigned a code so that none of the information is identifiable.

This form is valid only if the  
Clemson University IRB  
stamp of approval is shown here:

|  |
|--|
| CLEMSON UNIVERSITY<br>IRB CONSENT FORM<br>APPROVED <u>4/8/2014</u><br>EXPIRES <u>1/23/2015</u> |
|--|

## Choosing to Be in the Study

Your child does not have to be in this research study. You do not have to let your child be in the study. You may tell us at any time that you do not want your child to be in the study anymore. Your child will not be punished in any way if you decide not to let your child be in the study or if you stop your child from continuing in the study. Your child's grades will not be affected by any decision you make about this study.

If you choose to have your child stop taking part in this study, the information your child has already provided will be kept in a confidential manner.

We will also ask your child if they want to take part in this study. Your child will be able to refuse to take part or to quit being in the study at any time.

## Contact Information

If you have any questions or concerns about this study or if any problems arise, please contact Shaundra Daily at Clemson University at 864-656-5778.

If you have any questions or concerns about your child's rights in this research study, please contact the Clemson University Office of Research Compliance (ORC) at 864-656-6460 or [irb@clemson.edu](mailto:irb@clemson.edu). If you are outside of the Upstate South Carolina area, please use the ORC's toll-free number, 866-297-3071.

## Consent

**I have read this form and have been allowed to ask any questions I might have. I give my permission for my child to be in this study.**

**I consent for my child to wear the watch-like device:** \_\_\_\_\_ Yes \_\_\_\_\_ No

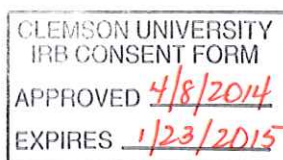
**I consent to the use of videotape during the lesson:** \_\_\_\_\_ Yes \_\_\_\_\_ No

**I consent to my child's participation in the survey:** \_\_\_\_\_ Yes \_\_\_\_\_ No

Parent's signature: \_\_\_\_\_ Date: \_\_\_\_\_

Child's Name: \_\_\_\_\_

A copy of this form will be given to you.





Child/Minor Agreement to Be in a Research Study  
Clemson University

**Field Studies for the Development and Deployment of a Classroom Engagement  
Pedometer**

You are being invited to be in a research study. Below you will find answers to some of the questions that you may have.

**Who Are We?**

- My name is Shelby S. Darnell. I am a PhD student at Clemson University in South Carolina

**What Is It For?**

- We are conducting a study to help us understand the kinds of things your teacher can do in the classroom to keep learning exciting.
- As you help us to understand what is exciting in your classes, we will be making a technology that will help teachers understand this about you.

**Why You?**

- You have been selected because you are in Ms./Mr. \_\_\_\_\_'s \_\_\_\_\_th grade class.
- During the study, you will be asked to share your opinion. None of the information you share will impact your relationship with your teacher or your grade in the class.

**What Will You Have to Do?**

- This study will last two weeks.
- During the study, you will be asked to wear a watch-like device on your wrist. This device can tell if your wrist is sweating more because of something significant you see or hear. It does not read your mind, but it can help us understand if you are interested in what you are doing.
- We will be videotaping during your class session so we can remember what your teacher was doing.
- You will also be asked to fill out a brief survey after your class and tell us how you felt about the lesson.
- We will not tell anyone that the information we have collected came from you.

**What Are the Good Things and Bad Things that May Happen to You If You Are in the Study?**

- The device should not painful at all. If you feel any discomfort, please let your teacher know, and she can help you remove it from your wrist.
- We hope we will learn how to help your teacher understand what you think is exciting teaching in the classroom.
- We also hope to, one day, help other students understand how they best learn in the classroom.

**What If You Want to Stop? Will You Get in Trouble?**

- Your participation in this study is voluntary. If at any time you wish to stop, please let your teacher or a researcher know.
- You will not be in any trouble for asking not to participate.
- None of the information we collect from you will positively or negatively impact your grades or your participation in other activities.

**Do You Have Any Questions?**

- You can ask questions at any time. You can ask them now. You can ask later. You can talk to me or you can talk to someone else at any time during the study. Here are the telephone numbers to reach us 864-656-5778. Shelby S. Darnell, School of Computing.

By signing below, I am saying that I have read this form and have asked any questions that I may have. All of my questions have been answered and I understand what I am being asked to do. I am willing and would like to be in this study.

|   |                          |                         |
|---|--------------------------|-------------------------|
| <b>I consent to wear the watch-like device:</b>             | <u>      </u> <b>Yes</b> | <u>      </u> <b>No</b> |
| <b>I consent to the use of videotape during the lesson:</b> | <u>      </u> <b>Yes</b> | <u>      </u> <b>No</b> |
| <b>I consent to participation in the survey:</b>            | <u>      </u> <b>Yes</b> | <u>      </u> <b>No</b> |

\_\_\_\_\_  
Signature of Child/Minor

\_\_\_\_\_  
Date

A copy of this form will be given to you.



## **Appendix B Middle School Documents**

### **B.1 Middle School Research Proposal Application**



# Proposal Summary for Conducting Research in Charlotte-Mecklenburg Schools

## Overview

All persons interested in conducting research in Charlotte-Mecklenburg Schools (CMS) must have prior approval. Research includes, but is not limited to: surveys, interviews, focus groups and classroom observations involving CMS students and/or staff. Researchers will be provided a copy of the district's [policy](#) on educational research, which should be reviewed prior to application. Please select the most current version of the Education Research document.

## CMS Review Process

All researchers must complete Sections A and B of the application below. Other research-related materials should be submitted at the time of application (e.g., questionnaires, consent forms, checklists, etc.).

### **Electronic submission of proposals is required.**

An approval decision will be made within 30 working days of our receiving the proposal, given the following conditions:

1. Proposals are in their final form having been reviewed and accepted by all regulatory committees, institutions or advisors. A certified copy of an institutional review board's approval must be submitted.
2. All supporting materials have been received.
3. Studies that have institutional support as follows.
  - a. *Professional*: Research is sponsored by universities, governmental agencies, or by similar nonprofit organizations engaged in scholarly research.
  - b. *Graduate Student*: Research is a dissertation or master thesis.
  - c. *Graduate Program Class Project*: Research is sponsored by a graduate school or university class and supervised by a faculty member. Findings are used only for a class project and not a thesis.

CMS places priority on those studies which address the goals outlined in the [Strategic Plan 2014](#). These goals include effective teaching and leadership, performance management, increasing the graduation rate, teaching and learning through technology, environmental stewardship and parent and community connections.

Depending upon scope and content, proposals may be subject to review by a research review panel consisting of CMS teachers, content experts, researchers and/or administrators. The panel's recommendations are given to the Chief Accountability Officer who makes the final decision to accept or reject a proposal.

*Please note that CMS charges a nominal fee for student-level data for external studies to cover staff resources needed to fulfill the request. If applicable, fees will be discussed at the time of application.*

### **Electronic submission of proposals is required.**

---

#### **Submit application and all supporting documents to:**

Susan Freije

[susanw.freije@cms.k12.nc.us](mailto:susanw.freije@cms.k12.nc.us)

#### **Please direct questions to:**

Mr. Frank D. Barnes

[frankd.barnes@cms.k12.nc.us](mailto:frankd.barnes@cms.k12.nc.us)

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## Proposal Summary for Conducting Research in Charlotte-Mecklenburg Schools

### SECTION A: APPLICATION INFORMATION

|  |  |   |
|--|--|---|
| Project Title: <b>Field Studies for the Development &amp; Deployment of a Classroom Engagement Pedometer</b>   |  |   |
|  |  |   |
| Researcher's Full Name(s): <b>Shelby Solomon Darnell</b>   |  | Title/Position: <b>Graduate Research Assistant</b>                  |
| University/Institution/Organization: <b>Clemson University, Human Centered Computing</b>   |  |   |
| Mailing Address*: <b>100 McAdams Hall, Clemson University, SC 29634</b>  |  |   |
| Email Address:<br><b>sdarnel@g.clemson.edu</b>   |  | Daytime Phone: <b>864-656-5778</b>                                  |
|  |  |   |
| Date Submitted†:   | Is this the final version of the proposal?   | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Projected Start Date:  |  |   |
| Projected Completion Date:<br><b>December 15, 2014</b>   | I have reviewed and understand the CMS <a href="#">policy</a> on educational research. | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
|  |  |   |
| The research is related to a:  |  |   |
| <input type="checkbox"/> Professional Project <input checked="" type="checkbox"/> Doctoral Study <input type="checkbox"/> Masters Study <input type="checkbox"/> Class Project |  |   |
|  |  |   |
| Have you included a copy of your Institutional Review Board (IRB) approval form with your application?   |  | <input type="checkbox"/> Yes <input type="checkbox"/> No            |

**ALL applicants MUST provide documentation from their institution's review board for the protection of human subjects before CMS will consider approval.**

|   |   |
|---|---|
| <b>Graduate Students Only: Please fill out the information below</b>  |   |
| <i>Charlotte-Mecklenburg Schools reserves the right to contact university faculty associated with a proposed research project. Advisor contact information is required for graduate student projects.</i> |   |
| Advisor's Name: <b>Shaundra Daily</b>   | Title/Position: <b>Assistant Professor</b>                          |
| Email Address: <b>sdaily@clemson.edu</b>  | Daytime Phone: <b>864-656-5778</b>                                  |
| Mailing Address: <b>100 McAdams Hall, Clemson, SC 29634</b>   |   |
| Have all advisory/regulatory committee members formally approved this research?   | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |

\* We will send your response to this address.

† Please note that you will receive a response no later than 30 business days from the date of submission.



## Proposal Summary for Conducting Research in Charlotte-Mecklenburg Schools

### SECTION B: STUDY SPECIFICATIONS

|  |   |   |   |
|--|---|---|---|
| <b>Study includes participants at a:</b><br><br><i>Check all that apply.</i> | <input type="checkbox"/> Pre-K School           | <input type="checkbox"/> Elementary School  | <input checked="" type="checkbox"/> Middle School |
|  | <input type="checkbox"/> High School            | <input type="checkbox"/> Alternative School | <input type="checkbox"/> Administrative Office    |
|  | <input type="checkbox"/> Other (please explain) |   |   |

|  |   |  |   |
|--|---|--|---|
| <b>Area(s) of study:</b><br><br><i>Check all that apply.</i> | <input checked="" type="checkbox"/> Language Arts<br><br><input checked="" type="checkbox"/> Social Studies<br><br><input type="checkbox"/> Foreign Language<br><br><input type="checkbox"/> Technology<br><br><input type="checkbox"/> Poverty<br><br><input type="checkbox"/> Effective Teaching and Leadership<br><a href="#">(See Strategic Plan 2014)</a><br><br><input checked="" type="checkbox"/> Teaching and Learning through Technology<br><a href="#">(See Strategic Plan 2014)</a> | <input checked="" type="checkbox"/> Mathematics<br><br><input checked="" type="checkbox"/> Art<br><br><input type="checkbox"/> Career/Vocational Education<br><br><input type="checkbox"/> Talented & Gifted<br><br><input type="checkbox"/> Exceptional Children with Disabilities<br><br><input type="checkbox"/> Performance Management<br><a href="#">(See Strategic Plan 2014)</a><br><br><input type="checkbox"/> Environmental Stewardship<br><a href="#">(See Strategic Plan 2014)</a> | <input checked="" type="checkbox"/> Science<br><br><input type="checkbox"/> Physical Education<br><br><input type="checkbox"/> After-School<br><br><input type="checkbox"/> ELL/ESL/LEP<br><br><input type="checkbox"/> Study Abroad<br><br><input checked="" type="checkbox"/> Increasing the Graduation Rate<br><a href="#">(See Strategic Plan 2014)</a><br><br><input type="checkbox"/> Parent and Community Connections<br><a href="#">(See Strategic Plan 2014)</a> |
|--|---|--|---|

|                       |                                       |                                      |   |
|-----------------------|---------------------------------------|--------------------------------------|---|
| <b>Type of study:</b> | <input type="checkbox"/> Quantitative | <input type="checkbox"/> Qualitative | <input checked="" type="checkbox"/> Mixed-Methods |
|-----------------------|---------------------------------------|--------------------------------------|---|

|  |   |
|--|---|
|  |   |
| Please list site(s) where research will be conducted:                              | Community House Middle School   |
| Are you a CMS employee? <sup>‡</sup>   | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No   |
| Has any CMS staff member already agreed to assist you upon approval of this study? | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br><i>If yes, please provide documentation of the agreement</i> |

<sup>‡</sup> If you are conducting research at your school, please submit a letter of approval from your principal on school letterhead.



## Proposal Summary for Conducting Research in Charlotte-Mecklenburg Schools

### SECTION B (*continued*)

| Does study employ:                             | <i>Check all that apply.</i>  |
|--|---|
| Non-school personnel surveys                   | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| School administrator surveys                   | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Teacher surveys                                | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Student surveys                                | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Parent surveys                                 | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Non-school personnel interviews                | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| School administrator interviews                | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Teacher interviews                             | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Student interviews                             | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Parent interviews                              | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Teacher assessment                             | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Student assessment                             | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Classroom observations                         | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Videotaping or audio recording of CMS staff    | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Videotaping or audio recording of CMS students | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |

| Does study access, require, and/or record:            | <i>Check all that apply.</i>  |
|---|---|
| Identifiable student-level information <sup>§</sup>   | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| De-identified student-level information <sup>**</sup> | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Identifiable staff-level information                  | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| De-identified staff-level information                 | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Aggregated student-level information                  | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Aggregated staff-level information                    | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| School-level information                              | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Other ( <i>please explain</i> )                       |   |

<sup>§</sup> Grades, test scores, IEP information, addresses, names of students. Please refer to CMS Educational Research Policy

<sup>\*\*</sup> Information that has been de-identified by CMS personnel

# Proposal Summary for Conducting Research in Charlotte-Mecklenburg Schools

## SECTION C: PROPOSAL SUMMARY

**Instructions:** Please answer each question below WITHIN THIS DOCUMENT. Use soft carriage returns (Shift+Enter) in form fields.

*Applications that do not follow the page limit guidelines will be returned for resubmission.*

*Please do not copy and paste your proposal.*

Relevant documents (e.g., consent forms, questionnaires, IRB approvals, etc.) should be sent electronically with this application.

### 1. What is the title of the research project?

Field Studies for the Development & Deployment of a Classroom Engagement Pedometer

### 2. Provide a brief (1,200 words maximum, 10 pt. font) literature review that summarizes the background and rationale for your study. This review should include appropriate peer-reviewed sources (attach separately). Please define acronyms or language specific to your field of study.

In a classroom environment, an instructor, at any given instance, must process and take action based on information gleaned not only from professional training, but also from a wide variety of data generated in real-time (Bromme & Brophy, 1986; Feldon, 2007). Some of these data, such as the number of students in the classroom, whether or not a particular student is standing or sitting, whether or not a student is asleep, drowsy, or alert, or whether or not students are conversing with one another are easily detected and monitored. Others, such as mood or learning challenges, are individual and context-dependent variables that may be difficult to objectively and accurately assess. Student engagement, which correlates directly to student performance (Appleton, Christenson, & Furlong, 2008; Elffers, Oort, & Karsten, 2012; Finn, 1989, 1993; J. A. Fredricks, Blumenfeld, & Paris, 2004; Klem & Connell, 2004; Shernoff, Csikszentmihalyi, Gilman, Huebner, & Furlong, 2009), falls into the latter category.

The assertion that student engagement is difficult to assess may seem counterintuitive. After all, many teachers, administrators, and other stakeholders, could speak with confidence, if asked, about what engagement is and what it “looks” like (Yazzie-Mintz & McCormick, 2012). So, if one knows what a characteristic is and how its presence is manifested, why would it be difficult to measure? The answer is that each individual has a unique set of perceptions and experiences that influence their understanding of the concept of engagement.

Consider, for example, color as an engagement analog. The human retina has a photoreceptive layer with many cells, including cones, which permit the detection of color. Amongst cone cells, there are three variants—long- (L), medium- (M), and short- (S) wavelength sensitive cones. The density of S-cones remains relatively constant between individuals (Hofer, Carroll, Neitz, Neitz, & Williams, 2005), but the ratio of L- to M-cones can vary widely from person to person (Neitz, Carroll, Yamauchi, Neitz, & Williams, 2002; Yamauchi et al., 2002). One might expect that this underlying physiological variability would cause corresponding differences in color identification. Instead, empirical evidence suggests high agreement between individuals, no matter their L/M ratio, on the identification of unique yellow (Yamauchi et al., 2002). In other words, an individual might not be able to explain their understanding of “yellow,” but when they are asked to identify the color yellow, much as when an instructor is asked to identify student engagement, they are likely to respond, “I know it when I see it” (Gewirtz, 1996).

The ability to recognize when a student is engaged, or when he or she has achieved a state of *flow* (Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2003), can take time to develop because it depends not only on an instructor’s observational skills but also on his or her ability to build relationships with students (Klem & Connell, 2004; Yazzie-Mintz & McCormick, 2012). The tasks of recognizing and monitoring engagement, thus, can prove especially challenging for student and preservice teachers. Novice teachers, like all teachers, must contend with the stress of working in a multi-task environment (Bromme & Brophy, 1986; Moos & Pitton, 2013). Unlike expert instructors, however, inexperienced teachers have more shallow “wells” of knowledge from which to draw decision making information, the data they store in working, or short-term, memory tend to be less effectively organized, and their decision making is more labored, leading to longer reaction times (Koubek, Benysh, & Tang, 1997; Moos & Pitton, 2013; Wickens & Hollands, 2000). The sum of these conditions results in higher reported levels of stress and increased feelings of being overwhelmed amongst preservice teachers, relative to experienced teachers (Feldon, 2007; Moos &

## Proposal Summary for Conducting Research in Charlotte-Mecklenburg Schools

Pitton, 2013). These observations suggest that a platform, which displays reliable, easily comprehensible data on student engagement, could be a valuable preservice teacher-training tool. The hypothetical tool could offer significant benefits to novice teachers, including reduced mental workload, reduced stress, and increased expertise in the assessment of engagement.

### 3. Briefly state the overall purpose of the study.

This study is designed to improve classroom engagement by providing teachers a way to reflect on their classrooms in a way previously impossible. We want to cooperatively build a tool to facilitate a new reflective class protocol in hopes of attaining more insight into understanding engagement through electrodermal activity and expert notes. We hope to build a tool that offers a new perspective on classroom engagement, enabling educators to better tailor lesson plans to classes.

### 4. What are the specific research questions and hypotheses for the study? *(Bullet form please)*

- Research question: How does one design a system that best serves the purpose of allowing teachers to better understand student engagement?
- Hypothesis: Combining physiological signals with situational context and expert notes allows for recognition of emotion in a way that can help people better understand engagement.

### 5. Provide a Methods section. This must include:

- **Procedures:** Please describe what will be done, how, and by whom, in appropriate detail for a reviewer to understand.
- **Sample:** How many participants do you need and from which school(s)?
- **Proposed Analyses:** How will you analyze your results?
- **Include copies of all surveys and/or instruments that you plan to use in your study.**
- **Include a letter of permission from your school's principal if you are a CMS employee conducting research in the school at which you work.**

What will be done:

1. Place Q sensors on desks
2. Set up and turn on cameras
3. Make sure students are wearing bracelets.
  - a. Have a seating chart of students and sensors
  - b. Correlate students with sensors
4. Allow teachers to give a brief overview of use of bracelets
5. Teacher goes through lesson until there's a natural break.
  - a. During teaching we write down what we see of the lesson plan
  - b. Use the teachers own lesson plan.
6. Student surveys are handed out to students and teachers at the end of the lesson.
7. Surveys are collected.
8. Teacher tells students to remove sensors.
9. We come in and break everything down.
  - a. Pull and re-encode video
    - i. Add video to EngageMe
  - b. Pull data from all sensors
    - i. Add students and EDA to EngageMe
10. Next day ask teachers to review the video and add notes.

These tasks will be carried out by Shelby Solomon Darnell and Melva James, research assistants of Shaundra Daily.

We want to record at least two classes from two teachers on separate days. We need to teachers to spend approximately 1 hour taking notes on students and classroom behaviors after the data is added to the system.

Participants:

- Teachers: two
- Students: approximately 30

## Proposal Summary for Conducting Research in Charlotte-Mecklenburg Schools

School: Community House Middle School

Proposed Analysis: Results will be analyzed by comparing several aspects of the recorded physiological signals to survey responses, teacher notes and emotion classification.

### Which Q is right for you?



#### Q Curve

- Optimized for long wear times, with an extended battery and inconspicuous form factor.
- Active environments such as shopping, sports, daily routines.
- Better suited for adult wrists, although children can wear the curve on the lower leg.
- Supports Bluetooth streaming of data, in addition to logging data on the device.



#### Q Sensor Pod

- Ideal for short-term wear or situations which require minimal baseline or warmup time.
- More passive scenarios such as response to watching something, talking with someone; using a computer.
- Works well on adult or child palms.
- Can strap onto wrist or legs, or can "stick" most anywhere on body with adhesive electrodes.
- Data logging only.

[View all features in depth](#)

[REQUEST MORE INFO](#)

Q sensor is an electrodermal activity sensor that unobtrusively measures skin conductance.

Survey for teachers: Teacher Observation of Classroom Engagement

Date \_\_\_\_\_

|   |        |          |         |                |         |
|---|--------|----------|---------|----------------|---------|
| Subject (please circle one)   |        |          | English | Math           | Science |
| Please provide a brief description of the lesson (today's lesson plan). |        |          |         |                |         |
|   |        |          |         |                |         |
| Was there a group work segment of the lesson?                           |        |          | Yes     | No             |         |
| Was the lesson lecture or discussion based?                             |        |          | Lecture | Discussion     |         |
| Did students present during the lesson?                                 |        |          | Yes     | No             |         |
| Percent of students engaged with the lesson:                            |        |          | 0-20%   |                |         |
| 21-40%  | 41-60% | 61-80%   | 81-100% |                |         |
| Were students engaged with the lesson?                                  |        |          |         |                |         |
| Strongly Disagree   |        | Disagree |         | Strongly Agree |         |

Survey for students: Student Survey of Engagement

1. What was your science/math lesson about today?
2. What was the most engaging aspect about today's lesson?
3. When were you most engaged in today's lesson?

1 = Strongly Disagree

2 = Disagree

3 = Agree

4 = Strongly Agree





## Proposal Summary for Conducting Research in Charlotte-Mecklenburg Schools

| Today in class:                               | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| I was paying close attention                  |   |   |   |   |
| My mind was on other things                   |   |   |   |   |
| The science/math lesson was very exciting     |   |   |   |   |
| I took notes on my lesson                     |   |   |   |   |
| I felt like I wanted to more about the topic  |   |   |   |   |
| I enjoyed how my teacher presented the lesson |   |   |   |   |

**6. What is your timeline for collecting data?**

February-September 2014

**7. Describe the materials, resources, information or other needs from the school system (such as demographic information, test scores, rates, etc.) and estimate the time required of CMS personnel to assist you. *Please note that there may be a fee for data requests.***

We need setup time, student names, daily lesson plan, and teachers using the system to take notes on class and student activity.

Estimated time:

- Setup before class: 15 minutes
- Teachers explaining study: 5 minutes
- Students filling out survey: 10 minutes
- Teachers using system and taking notes: 2 hours
- Break down after class: 15 minutes

**8. Identify any ethical issues you feel may be of concern to CMS or parents, and explain how you have addressed them.**

Privacy is the main issue because the classroom is being video recorded, and students will initially be identified by their names so teachers can make entries into the system. Before the data is analyzed all student names in the database will be replaced with study identification values that can not be associated with any student. All recorded video will have student faces blurred, before being used in any research presentations. Another possible concern would be using the data to evaluate the performance of students and teachers. Our research is not focused on student or teacher performance, it is based on finding a link between electrodermal activity and engagement. No analysis on student or teacher performance will be made; as such, we will not record or ask for any type of achievement scores concerning student or teacher performance.

**9. What is your plan to share and disseminate results (i.e. state with whom and how your will share your results)?**

We plan to publish research, that maintains the anonymity of the teachers and students. Observations made by way of the study will be reported in scholarly publications, and will be shared with the Bill and Melinda Gates foundation.

**10. Proposal Summary**

**This section of your application will be sent to readers for the first stage of the review process.**

*Suggestion: Write in a language that can be understood by those not in your field. Also, the reader needs to understand the what, why, and how of your study in one brief paragraph.*



## Proposal Summary for Conducting Research in Charlotte-Mecklenburg Schools

Engagement has been observed to be a positive proponent to learning. Our desire is to build and test a tool that enables teachers to better understand their students engagement. Our hope is that given a better understanding of student engagement, a teacher will use this knowledge to prolong student engagement during instruction. This will occur by the teacher learning what keeps their students most engaged. As researchers, building and testing this tool will help us better understand the connection between electrodermal activity and engagement. This research gives us an opportunity to possibly create a tool that can help teachers and students at all levels improve engagement. A more engaged student population can positively affect all aspects of school life. A more engaged student population can lead to a better future.

## B.2 Middle School Memorandum of Agreement



**Office of Accountability**

600 East Fourth Street, 5<sup>th</sup> Floor  
Charlotte, North Carolina 28202  
980-344-0037

April 10, 2014

Shelby Solomon Darnell  
100 McAdams Hall  
Clemson University, SC 29634

RE: Field Studies for the Development & Deployment of a Classroom Engagement Pedometer

Dear Shelby Solomon Darnell,

Thank you for your interest in conducting research in the Charlotte-Mecklenburg Schools. Your proposal summary and application for "Field Studies for the Development & Deployment of a Classroom Engagement Pedometer" has been reviewed and approved by the Office of Accountability.

Please register at <https://www.cmsvolunteers.com/> for clearance if you plan to enter any school for research-related purposes at any time.

Given the increasing level of accountability placed upon schools, and the need to recruit and retain quality teachers, identifying programs and strategies that work is of paramount importance. CMS asks that you share your results within 30 days of completion, including any recommendations for the district based upon your findings.

Please sign and return one copy of the enclosed CMS "Memorandum of Understanding" indicating your agreement with its terms. Please retain the remaining copy for your records. Should you have any questions or future needs, please feel free to contact Lindsay Messinger, Director of Research, Evaluation, and Analytics, at [lindsay1.messinger@cms.k12.nc.us](mailto:lindsay1.messinger@cms.k12.nc.us). Best wishes and continued success as you begin your study.

Sincerely,

A handwritten signature in blue ink, appearing to read "F. Barnes", with a long, sweeping horizontal line extending to the right.

Frank D. Barnes  
Chief Accountability Officer  
Charlotte-Mecklenburg Schools  
[frankd.barnes@cms.k12.nc.us](mailto:frankd.barnes@cms.k12.nc.us)

## **MEMORANDUM OF UNDERSTANDING**

This Memorandum of Understanding (hereinafter "MOU") is made and entered into this April 10, 2014 by and between The Charlotte-Mecklenburg Board of Education (the "Board" or "CMBE" or "CMS") and Shelby Solomon Darnell/ Clemson University, Human Centered Computing (hereinafter "Researcher").

### **RECITALS**

**WHEREAS**, the Board desires to better serve children and improve educational opportunities and instruction within CMS;

**WHEREAS**, Researcher has agreed to conduct research through the "Field Studies for the Development & Deployment of a Classroom Engagement Pedometer" study in order to assist the Board with better serving and improving educational opportunities for children within CMS;

**WHEREAS**, in light of the desires of both parties, the Board and Researcher will work cooperatively together to implement the study, "Field Studies for the Development & Deployment of a Classroom Engagement Pedometer."

**NOW THEREFORE**, for and in consideration of the mutual promises and obligations contained herein, the parties hereto agree as follows:

### **AGREEMENT**

#### **A. The Board Agrees to the Following Obligations:**

- 1. To provide the following information to Researcher:**
  - a. No data requested
- 2. To provide Researcher with access to participating staff and students:**
  - a. The Board will provide Researcher with access to staff to clarify any questions regarding the information provided.
- 3. To allow Researcher to access data:**
  - a. The Board will provide the data to Researcher identified in Section A, subsections (1) through (2), by providing access to CMBE staff familiar with the requested data.

#### **B. Researcher Agrees to the Following Obligations:**

- 1. Researcher's staff who will have direct, in-person contact with CMS students will apply for CMS clearance at: <https://www.cmsvolunteers.com/>.**
- 2. Researcher will ensure confidentiality of data by ensuring the following:**

- a. All electronic data analysis will be performed on secure, password protected computers;
- b. All electronic data (i.e. personally identifiable information) collected from the Board must only be used for the purposes outlined in this MOU; and
- c. Access to all electronic data gathered shall be made available only to those individuals on Researcher's staff with a need to know, and Researcher should take steps to maintain the confidentiality of the electronic data at all stages of the study.

**3. Disclosure of results of analysis:**

- a. Data are being collected as part of a study. No separate analysis relating to CMBE will be conducted and no information about CMBE will be reported. Shelby Solomon Darnell shall provide the analysis of any data gathered as a result of this MOU to the CMBE Office of Accountability and Center for Research and Evaluation staff, prior to disclosing it to any other source
- b. Researcher shall maintain the confidentiality and safeguard the analysis of any data gathered as a result of this MOU, and will not, without the prior consent of the other party, disclose any findings or analysis derived from such non-public information other than (i) summary data that does not identify any individual person including expenditure patterns, and expenditure per pupil or category of pupil calculated using the methodology of such party, (ii) data and analysis of such summary data used to promote the educational and research purposes of such party, including, without limitation, such data and analysis in a database designed to compare expenditure patterns across school districts and (iii) data and findings that have been made publicly available without breaching any of the disclosing party's confidentiality obligations.

**4. Parent Consent:**

- a. The organization maintains active parent consent on the student level data requested.

**C. Duration of the MOU**

**1. Term**

- a. This MOU will become effective immediately upon execution and shall terminate one (1) year from the date of execution or as otherwise specified.
- b. Prior to the termination date, this MOU may be terminated by either party, upon ten (10) days' written notice to the non-terminating party.

- c. Personally identifiable data will be destroyed when no longer needed for matching. Researcher will not disclose personally identifiable data to a 3<sup>rd</sup> party.

## **2. Survival of Confidentiality**

- a. The provisions regarding the confidentiality of CMBE data shall survive the term of this MOU.

## **D. General Terms and Conditions**

1. The obligations herein assumed by the parties shall be governed by the laws of the State of North Carolina.
2. The parties agree that each party shall bear its own costs, if any, in connection with the execution of their respective duties/obligations undertaken pursuant to this MOU.
3. The parties hereto agree that they are independent of each other and neither party shall be deemed an employee, servant, agent, partner or joint venturer of the other and nothing in this MOU shall be construed to make the parties employees, servants, agents, partners or joint ventures of the other party.
4. For purposes of sending reports and/or notices, it shall be accomplished, if sent, via U.S. Mail, return receipt requested, postage prepaid or courier service, as follows:

### **If to the Board:**

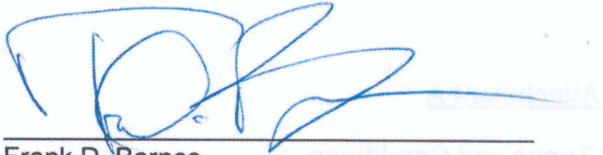
To: Frank D. Barnes  
Chief Accountability Officer  
Charlotte-Mecklenburg Schools  
600 East Fourth Street, Fifth Floor  
Charlotte NC 28202

### **If to Researcher:**

To: Shelby Solomon Darnell  
100 McAdams Hall  
Clemson University, SC 29634

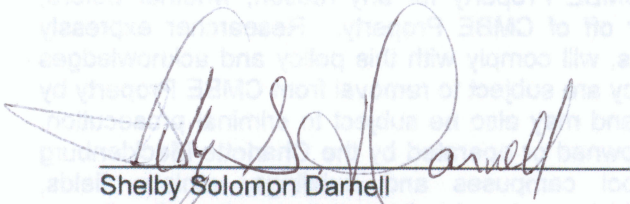
5. This MOU may be amended or modified upon the mutual written consent of both parties.
6. The parties agree to the additional terms and conditions that are attached hereto and incorporated herein, which are labeled as "Attachment A." If there is any conflict between the general terms and conditions as identified herein-above and Attachment A, then the applicable term and/or condition identified in Attachment A shall supersede any such conflicting provision contained herein.





Frank D. Barnes  
Chief Accountability Officer  
Charlotte-Mecklenburg Schools

4/14/14  
Date



Shelby Solomon Darnell  
Graduate Research Assistant  
Clemson University, Human Centered Computing

4/15/2014  
Date



## **Attachment A**

### **Standard Terms and Conditions**

1. **Compliance with All Laws.** Researcher warrants that all performance hereunder shall be in accordance with all applicable federal, state and local laws, regulations and orders.
2. **Registered Sex Offenders.** Researcher acknowledges that CMBE Policy ADDA, "Registered Sex Offenders," prohibits anyone registered or required to register as a sex offender from being present on any CMBE Property for any reason, whether before, during or after school hours, or on or off of CMBE Property. Researcher expressly agrees that it, and any of its employees, will comply with this policy and acknowledges that any individuals that violate this policy are subject to removal from CMBE Property by CMS and/or law enforcement officials and may also be subject to criminal prosecution. "CMBE Property" includes all property owned or operated by the Charlotte-Mecklenburg Board of Education, including school campuses and buildings, athletic fields, playgrounds, parking lots, bus stops, vehicles, school buses, activity buses and any other properties owned or controlled by CMS. If Researcher, any of Researcher's employees, or any of Researcher's subcontractors or employees of subcontractors will have any direct interaction with students, then Researcher or the subcontractor must (i) on an annual basis conduct a check of the N.C. Sex Offender and Public Protection Registration Program, the N.C. Sexually Violent Predator Registration Program and the National Sex Offender Registry for all such employees; and (ii) prohibit individuals listed on such registries from being on CMBE Property.
3. **Indemnification.** Researcher shall indemnify and hold harmless CMBE, its officers, agents, employees and assigns from and against all claims, losses, costs, damages, expenses, attorneys' fees and liability that any of them may sustain (a) arising out of Researcher's failure to comply with any applicable law, ordinance, regulation, or industry standard or (b) arising directly or indirectly out of Researcher's performance or lack of performance of the terms and conditions of the MOU.
4. **Insurance.** Unless such insurance requirements are waived or modified by CMBE or the Charlotte-Mecklenburg Department of Insurance and Risk Management ("DIRM"), Researcher certifies that it currently has and agrees to purchase and maintain during its performance under the MOU the following insurance from one or more insurance companies acceptable to CMBE and authorized to do business in the State of North Carolina: Automobile - Researcher shall maintain bodily injury and property damage liability insurance covering all owned, non-owned and hired automobiles. The policy limits of such insurance shall not be less than \$1,000,000 combined single limit each person/each occurrence. Commercial General Liability - Researcher shall maintain commercial general liability insurance that shall protect Researcher from claims of bodily injury or property damage which arise from performance under the MOU. This insurance shall include coverage for contractual liability. The policy limits of such insurance shall not be less than \$1,000,000 combined single limit each occurrence/annual aggregate. Worker's Compensation and Employers' Liability Insurance - If applicable to Researcher, Researcher shall meet the statutory requirements of the State of North Carolina for

worker's compensation coverage and employers' liability insurance. Researcher shall also provide any other insurance or bonding specifically recommended in writing by the DIRM or required by applicable law. Certificates of such insurance shall be furnished by Researcher to CMBE and shall contain the provision that CMBE be given 30 days' written notice of any intent to amend or terminate by either Researcher or the insuring company. Failure to furnish insurance certificates or to maintain such insurance shall be a default under the MOU and shall be grounds for immediate termination of the MOU.

5. **Termination for Convenience.** In addition to all of the other rights which CMBE may have to cancel this MOU, CMBE shall have the further right, without assigning any reason therefore, to terminate any work under the MOU, in whole or in part, at any time at its complete discretion by providing 10 days notice in writing from CMBE to Researcher.
6. **Termination for Default.** CMBE may terminate the MOU, in whole or in part, immediately and without prior notice upon breach of the MOU Contract by Researcher.
7. **Contract Transfer.** Researcher shall not assign, subcontract or otherwise transfer any interest in the MOU without the prior written approval of CMBE.
8. **Contract Personnel.** Researcher agrees that it has, or will secure at its own expense, all personnel required to perform the services set forth in the MOU.
9. **Key Personnel.** Researcher shall not substitute for key personnel (defined as those individuals identified by name or title in the MOU or in written communication from Researcher) assigned to the performance of the MOU without prior written approval from CMBE Project Coordinator (the individual at CMBE responsible for administering the MOU).
10. **Contract Modifications.** The MOU may be amended only by written amendment duly executed by both CMBE and Researcher. However, minor modifications may be made by CMBE Project Coordinator to take advantage of unforeseen opportunities that do not change the intent of the MOU or the scope of Researcher 's performance. Minor modifications to the MOU must be recorded in writing and signed by both the CMBE Project Coordinator and Researcher, and placed on file with the MOU.
11. **Advertisement.** The MOU will not be used in connection with any advertising by Researcher without prior written approval by CMBE.
12. **Nondiscrimination.** During the performance of the MOU, Researcher shall not discriminate against or deny the MOU's benefits to any person on the basis of sexual orientation, national origin, race, ethnic background, color, religion, gender, age or disability.
13. **Conflict of Interest.** Researcher represents and warrants that no member of CMBE or any of its employees or officers who may obtain a direct benefit, personal gain or advantage for themselves or a relative or associate as a result of the MOU, subcontract or other agreement related to the MOU is in a position to influence or has attempted to influence the making of the MOU, has been involved in making the MOU, or will be involved in administering the MOU. Researcher shall cause this paragraph to be included in all memorandums of understanding, agreements, subcontracts and other agreements related to the MOU.
14. **Gratuities to CMBE.** The right of Researcher to proceed may be terminated by written notice if CMBE determines that Researcher, its agent or another representative offered or gave a gratuity to an official or employee of CMBE in violation of policies of CMBE.
15. **Kickbacks to Researcher.** Researcher shall not permit any kickbacks or gratuities to be provided, directly or indirectly, to itself, its employees, subcontractors or subcontractor employees for the purpose of improperly obtaining or rewarding favorable treatment in connection with a CMBE contract or in connection with a subcontract relating to a CMBE contract. When Researcher has grounds to believe that a violation of this clause may

have occurred, Researcher shall promptly report to CMBE in writing the possible violation.


16. **Monitoring and Evaluation.** Researcher shall cooperate with CMBE, or with any other person or agency as directed by CMBE, in monitoring, inspecting, auditing or investigating activities related to the MOU. Researcher shall permit CMBE to evaluate all activities conducted under the MOU. CMBE has the right at its sole discretion to require that Researcher remove any employee of Researcher from CMBE Property and from performing services under the MOU following provision of notice to Researcher of the reasons for CMBE's dissatisfaction with the services of Researcher's employee.
17. **Financial Responsibility.** Researcher is financially solvent and able to perform under the Contract.
18. **Governmental Restrictions.** In the event any governmental restrictions are imposed which necessitate alteration of the material, quality, workmanship or performance of the items offered prior to their delivery, it shall be the responsibility of the Researcher to notify, in writing, the issuing purchasing office at once, indicating the specific regulation which required such alterations. CMBE reserves the right to accept any such alterations, including any price adjustments occasioned thereby, or to cancel the MOU.
19. **Confidential Information.** Student Information: If, during the course of Researcher's performance of the MOU Researcher should obtain any information pertaining to the students' official records, Researcher agrees to keep any such information confidential and to not disclose or permit it to be disclosed, directly or indirectly, to any person or entity. The MOU shall not be construed by either party to constitute a waiver of or to in any manner diminish the provisions for confidentiality of students' records. Additionally, pursuant to N.C.G.S. 115C-401.1, it is unlawful for a person who enters into a contract with a local board of education to sell personally identifiable information that is obtained from a student as a result of that person's performance under the MOU. Employee Personnel Information: If, during the course of Researcher's performance of the MOU, Researcher should obtain any information pertaining to employees of CMBE's personnel records, Researcher agrees to keep any such information confidential and to not disclose or permit it to be disclosed, directly or indirectly, to any person or entity. Other Confidential Information: (a) Researcher agrees that it will at all times hold in confidence for CMBE all designs, know-how, techniques, devices, drawings, specifications, patterns, technical information, documents, business plans, item requirements, forecasts and similar data, oral, written or otherwise, conveyed by CMBE to Researcher in connection herewith or procured, developed, produced, manufactured or fabricated by Researcher in connection herewith or procured, developed, produced, manufactured or fabricated by Researcher in connection with Researcher's performance hereunder (collectively, "Information"). Researcher shall exercise the same degree of care to prevent disclosure of any Information to others as it takes to preserve and safeguard its own proprietary information, but in any event, no less than a reasonable degree of care. Researcher shall not, without the prior written consent of CMBE, reproduce any Information; nor disclose Information to any party; nor use any Information for any purpose other than performance for the benefit of Researcher hereunder, and/or (b) any technical knowledge or information of Researcher which Researcher shall have disclosed or may hereafter disclose to CMBE in connection with the goods or other performance covered by the MOU shall not, unless otherwise specifically agreed upon in writing by CMBE, be deemed to be confidential or proprietary information and shall be acquired by CMBE free from any restrictions as part of the consideration of the MOU.
20. **Intellectual Property.** Researcher agrees, at its own expense, to indemnify, defend and save CMBE harmless from all liability, loss or expense, including costs of settlement and attorney's fees, resulting from any claim that CMBE's use, possession or sale of the

goods or services infringes any copyright, patent or trademark or is a misappropriation of any trade secret.

21. **No Pre-Judgment or Post-Judgment Interest.** In the event of any action by Researcher for breach of contract in connection with the MOU, any amount awarded shall not bear interest either before or after any judgment, and Researcher specifically waives any claim for interest.
22. **Background Checks.** At the request of CMBE's Project Coordinator, Researcher (if an individual) or any individual employees of Researcher shall submit to CMBE criminal background check and drug testing procedures.
23. **Mediation.** If a dispute arises out of or relates to the MOU, or the breach of the MOU, and if the dispute cannot be settled through negotiation, the parties agree to try in good faith to settle the dispute by mediation administered by the American Arbitration Association under its Commercial Mediation Rules before resorting to litigation.
24. **No Third Party Benefits.** The MOU shall not be considered by Researcher to create any benefits on behalf of any third party. Researcher shall include in all contracts, subcontracts or other agreements relating to the MOU an acknowledgment by the contracting parties that the MOU creates no third party benefits.
25. **Force Majeure.** If CMBE is unable to perform its obligations or to accept the services or goods because of Force Majeure (as hereinafter defined), the time for such performance by CMBE or acceptance of services will be equitably adjusted by allowing additional time for performance or acceptance of services equal to any periods of Force Majeure. "Force Majeure" shall mean any delays caused by acts of God, riot, war, terrorism, inclement weather, labor strikes, material shortages and other causes beyond the reasonable control of CMBE.
26. **Ownership of Documents.** All documents created pursuant to the Contract shall, unless expressly provided otherwise in writing, be owned by CMBE. Upon the termination or expiration of the Contract, any and all finished or unfinished documents and other materials produced by Researcher pursuant to the Contract shall, at the request of CMBE, be turned over to CMBE. Any technical knowledge or information of Researcher which Researcher shall have disclosed or may hereafter disclose to CMBE shall not, unless otherwise specifically agreed upon in writing by CMBE, be deemed to be confidential or proprietary information and shall be acquired by CMBE free from any restrictions as part of the consideration of the Contract.
27. **Strict Compliance.** CMBE may at any time insist upon strict compliance with these terms and conditions notwithstanding any previous course of dealing or course of performance between the parties to the contrary.
28. **General Provisions.** CMBE's remedies as set forth herein are not exclusive. Any delay or omission in exercising any right hereunder, or any waiver of any single breach or default hereunder, shall not be deemed to be a waiver of such right or of any other right, breach, or default. If action be instituted by Researcher hereunder, CMBE shall be entitled to recover costs and reasonable attorney's fees. Researcher may not assign, pledge, or in any manner encumber Researcher's rights under this MOU, or delegate the performance of any of its obligations hereunder, without CMBE's prior, express written consent.
29. **Contract Situs.** All matters, whether sounding in contract or tort relating to the validity, construction, interpretation and enforcement of the MOU, will be determined in Mecklenburg County, North Carolina. North Carolina law will govern the interpretation and construction of the MOU.

### B.3 Middle School Student Survey of Momentary Engagement Part 1

# Middle School Student Survey of Momentary Engagement part 1

A stack of several old, worn books with leather and cloth covers, showing signs of age and use.[Edit this form](#)

Questions to ask students before the study begins.

\* Required

**Name \***

**Gender \***

☐ Male

☐ Female

☐ Other:

**Do you know how you act when you're really focused on accomplishing a goal?**

\*

☐ Yes

☐ No

☐ Kinda

☐ Not sure

**How do you believe you act when completely engrossed in a classroom activity?**

\*



**What types of classroom activities keep you most engaged/interested/on task?**

\*



**What type of learning activity do you look forward to most in this class? \***

Submit

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## B.4 Middle School Student Survey of Momentary Engagement Part 2



# Middle School Student Survey of Momentary Engagement part 2

 Edit this form

After class student survey

\* Required

Name \*

Teacher Name \*

What was your favorite activity from your earlier class? \*

What was the most engaging aspect about today's lesson? \*

**Why was that the most engaging aspect for you? \***



**When were you most engaged in today's lesson? \***

Please provide an approximate time or event (something the teacher did)



**What would make you feel better about today's work/lesson? \***



**How many times did you feel highly engaged in classroom activity? \***

**Today in class: I was paying close attention. \***

1 2 3 4

Strongly Disagree ☐ ☐ ☐ ☐ Strongly Agree

**Today in class: My mind was on other things. \***

1 2 3 4

Strongly Disagree ☐ ☐ ☐ ☐ Strongly Agree

---

**Today in class: The lesson was very exciting. \***

1 2 3 4

---

Strongly Disagree ☐ ☐ ☐ ☐ Strongly Agree

---

**Today in class: I took notes on my lesson. \***

1 2 3 4

---

Strongly Disagree ☐ ☐ ☐ ☐ Strongly Agree

---

**Today in class: I felt like I wanted to learn more about the topic. \***

1 2 3 4

---

Strongly Disagree ☐ ☐ ☐ ☐ Strongly Agree

---

**Today in class: I enjoyed how my teacher presented the lesson. \***

1 2 3 4

---

Strongly Disagree ☐ ☐ ☐ ☐ Strongly Agree

---

Submit

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## B.5 System Usability Scale

# System Usability Scale

[Edit this form](#)

\* Required

Name \*

I think that I would like to use this system frequently. \*

1 2 3 4 5

Strongly disagree ☐ ☐ ☐ ☐ ☐ Strongly agree

I found the system unnecessarily complex. \*

1 2 3 4 5

Strongly disagree ☐ ☐ ☐ ☐ ☐ Strongly agree

I thought the system was easy to use \*

1 2 3 4 5

Strongly disagree ☐ ☐ ☐ ☐ ☐ Strongly agree

**I think that I would need the support of a technical person to be able to use this system. \***

1 2 3 4 5

Strongly disagree ☐ ☐ ☐ ☐ ☐ Strongly agree

**I found the various functions in this system were well integrated. \***

1 2 3 4 5

Strongly disagree ☐ ☐ ☐ ☐ ☐ Strongly agree

**I thought there was too much inconsistency in this system. \***

1 2 3 4 5

Strongly disagree ☐ ☐ ☐ ☐ ☐ Strongly agree

**I would imagine that most people would learn to use this system very quickly. \***

1 2 3 4 5

Strongly disagree ☐ ☐ ☐ ☐ ☐ Strongly agree

**I found the system very cumbersome to use. \***

1 2 3 4 5

## B.6 Usefulness and Usability Survey

# Usefulness and Usability Survey – for teachers

\* Required

## Usefulness

Please rate each statement on the given scale.

This system supports critical aspects. \*

1 2 3 4 5 6 7

Strongly Disagree ☐ ☐ ☐ ☐ ☐ ☐ ☐ Strongly Agree

This system enhances my effectiveness on the job. \*

1 2 3 4 5 6 7

Strongly Disagree ☐ ☐ ☐ ☐ ☐ ☐ ☐ Strongly Agree

Overall, I find this system useful in my job. \*

1 2 3 4 5 6 7

Strongly Disagree ☐ ☐ ☐ ☐ ☐ ☐ ☐ Strongly Agree

## Engagement



This system has changed my understanding of student engagement. \*

1 2 3 4 5 6 7

Strongly Disagree ☐ ☐ ☐ ☐ ☐ ☐ ☐ Strongly Agree

If the system has changed your understanding of student engagement, please explain how. \*

## Usability

This website is easy to use. \*

1 2 3 4 5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

I am able to find what I need quickly on this website. \*

1 2 3 4 5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

I enjoy using the website. \*

1 2 3 4 5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

It is easy to navigate within the website. \*

1 2 3 4 5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

## Credibility

I can count on the information I get on this website. \*

1 2 3 4 5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

The information on this website is valuable. \*

1 2 3 4 5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

## Loyalty

How likely are you to recommend this website to a friend or colleague? \*

I would like to visit this website in the future. \*

1 2 3 4 5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

## Appearance

I find the website to be attractive. \*

1 2 3 4 5

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